Information Technology

and

Intelligent Transportation Systems

2003–2008

Strategic Plan Detail

Volume II

January 19, 2004

Prepared for
Miami-Dade Transit

By
The Palisades Group USA

ACKNOWLEDGMENTS

This IT / ITS Strategic Plan Detail (Volume II) report was produced for Miami-Dade Transit (MDT) Information Technology Services, as part of the IT / ITS 2003–2008 Strategic Planning process under the direction of **Ms. Rosie Perez**, Senior Chief of MDT Information Technology and Support Services, and **Ms. Susanna Guzman-Arean**, Acting Chief of MDT Information Technology Services. The development of the report depended on the active participation of MDT senior Information Technology Services and Support Services managers and personnel.

This report is one of a series of documents produced as a part of 2003–2008 IT / ITS Strategic Planning process. The other key documents are listed in the References section of this report.

Administrative planning and support were provided by **Michelle Abaunza** of MDT, **Joel Volinski**, **Rob Gregg**, and **Fabian Cevallos** of the University of South Florida's Center for Urban Transportation Research, and **Ellen Thompson** and **Lawrence Xiang** of Palisades Group USA.

The Project Team from Palisades Group USA worked collaboratively to plan and produce the strategic planning effort and this report. The team members, with their primary areas of expertise noted, included **Eric Heimall** (Technical Architect), **Mimi Hwang** (Project Manager, Systems Architect), **Bill Kronenberger** (Onboard Engineer), **Eva Lerner-Lam** (Executive Program Manager), **Robert McGoff** (Network Engineer), **Nancy Neuerburg** (Business and ITS Architect), **Paula Okunieff** (Data / Application and ITS Architect), and **Audrey White** (Data Modeler). This report was originally created by the Palisades Project Team members unless otherwise noted.

IT/ITS 2003–2008 STRATEGIC PLAN DOCUMENTS

Three final reports were produced in this strategic planning process:

1. Volume I: *IT/ITS 2003–2008 Strategic Plan Summary* provides a summary for all audiences, including executive management.
2. Volume II: *IT/ITS 2003–2008 Strategic Plan Detail* provides details and technical documentation on the IT / ITS Strategic Plan. The primary audience for Volume II is Information Technology Services staff.
3. *Intelligent Transportation Systems (ITS) 2003–2008 Strategic Plan* is intended for staff working on ITS projects and other interested audiences. This report describes MDT's intelligent transportation system strategies, initiatives, and issues.

Several other interim reports were generated as supporting documentation for the IT / ITS Strategic Plan:

- The Current or "As-Is" Architecture is described in the *Final Interim Report, July 15, 2003*.
- IT / ITS 2003–2008 Strategic Planning Process Technical Memorandum: Areas for Architecture Enhancement.
- The process and components used to develop the future or Target Architecture are described in the *Logical Target Architecture Workshop Report, August 28, 2003* and the *Target Physical/Technical Architecture Workshop Report, September 2, 2003*.

Purpose of this Volume
Volume II of provides details and technical documentation on IT / ITS 2003–2008 Strategic Plan. Technical appendices to Volume II provide further detail on the Data and Application Architecture and the Technology Architecture.

Intended Audience
The intended audience is Information Technology staff.

TABLE OF CONTENTS

INDEX OF FIGURES

INDEX OF TABLES

1 INTRODUCTION

1.1 Purpose of Volume II

This second volume of the Miami-Dade Transit Information Technology (IT) and Intelligent Transportation (ITS) Systems 2003–2008 Strategic Plan is titled *IT/ITS 2003–2008 Strategic Plan Detail*. It contains detailed descriptions that support Volume I, *the IT/ITS Strategic Plan Summary*. For example, it contains more detailed explanations of items highlighted in Volume I, such as the strategic planning process and methodology and the Gartner Group Rapid Assessment. It also contains detailed summaries of the data / application architecture, on-board architecture, technology architecture, and the strategic initiatives.

This report does not include the important discussion, which is included in Volume I, describing the MDT business environment and goals that help drive the IT / ITS strategies and proposed investments. The reader is also directed to Volume I for a discussion of the role of technology, and a chapter on the Information Technology Services Division, including its mission, values, vision, goals, objectives, guiding principles, and critical success factors.

1.2 Intended Audience

The intended audience for this report is Information Technology Services staff.

2 THE STRATEGIC PLANNING PROCESS

2.1 Why a Strategic Planning Process?

As service demands grow and business issues become more complex, a critical need across the Miami-Dade Transit (MDT) business units will be the timely access to operating information whenever and wherever needed. This computer-based data must be accurate and consistent throughout every division, and in a useful format that can be easily interpreted. In addition, the implementation of Intelligent Transportation Systems (ITS) will require the Information Technology (IT) Division to focus on increasingly complex data and technology issues. The success of these systems, and the management of the underlying data, is significant to the support of MDT's current and future services. An IT/ITS strategic planning process for a transit agency is critical for both maximizing the benefits of technology investments and for minimizing risks. An IT/ITS Strategic Plan supports the timely, cost effective, and appropriate implementation of technology.

The strategic planning process creates an opportunity and provides a framework for information technology staff and their clients to plan for future improvements. It provides a process to reassess their current and future operating environment, consider future needs, refine goals and strategic objectives, better understand interrelationships and integration benefits, and define potential improvements to their business efficiency and effectiveness.

A comprehensive look at existing data and systems, coupled with a strategic plan, helps to do the following:

- Refine and communicate priorities so that appropriate technology investments are made at the right time to achieve the "best bang for the buck"
- Improve the ability to attain the business needs
- Avoid duplication of systems and data acquisition
- Avoid duplicative maintenance of systems and data
- Provide seamless integration among systems
- Identify opportunities for leveraging budgets and staff resources by partnering with other business areas or agencies
- Improve understanding and documentation of existing systems and hardware to better support maintenance activities and training of staff
- Optimize use of networks and hardware
- Communicate standards to reduce complexity and maintenance costs
- Communicate business rationale for proposed technology investments

2.2 Approach to Strategic Plan

The approach to the IT/ITS Strategic Plan is designed to obtain a comprehensive view of Transit that leads to an IT/ITS plan that supports Transit's success. The approach uses a structured and tested methodology that is described in the next section. In the course of implementing the structured methodology, a variety of techniques will be used to gather the necessary information and involve Transit staff in the development of the Strategic Plan. Executive interviews, staff interviews, interactive workshops, architectural diagrams,

presentations, and interim reports are but a few of the tools and techniques that will be used.

2.2.1 Enterprise Architecture Planning (EAP)

The Project Team will use an Enterprise Architecture Planning (EAP) process specifically focused on Transit's needs to develop the IT/ITS Strategic Plan.

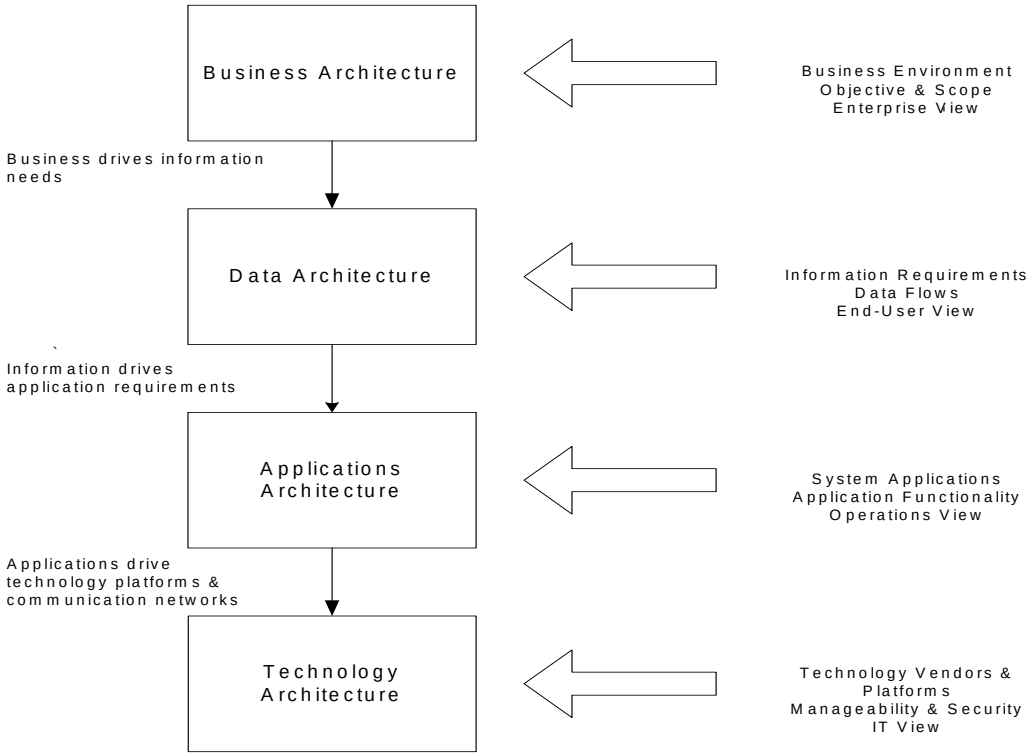
The EAP process establishes an agency-wide roadmap to achieve the agency's mission through supporting optimal performance of its core business processes within an efficient information technology environment. It is a method for defining an organization's current (baseline) or desired (target) environment, and is essential for evolving information systems and inserting emerging technologies such as ITS that optimize mission value.

EAP has been approved by the Federal CIO Council (1998) to promote shared development, interoperability, and sharing of information for federal agencies and other government entities. In general, the reason for using the EAP process to define the Strategic Plan is to ensure:

- Alignment — ensure the goals of the plan meet management's intent.
- Integration — ensure business rules are consistent across the organization, the data, their use, interfaces, and information flow are standardized, and the interoperability and connectivity are managed across the enterprise.
- Change — assist in the facilitation and management of change to any area of the enterprise.
- Time-to-market — reduce cost and effort of systems development, modernization time frames, and resource requirements.
- Service model — disciplined evolvement of standard and quality IT services.

EAP planning is typically done in four architectural layers, as illustrated in Figure 2-1.

Figure 2-1 Enterprise Architecture Planning



2.2.2 IT/ITS Strategic Planning Approach

Through EAP, the MDT 2003–2008 IT Strategic Plan will provide the framework to begin the definition of documented and coordinated structures for crosscutting business needs and design developments, and support collaboration among the divisions for increased efficiency and improved services to the transit customer. The Palisades IT/ITS strategic planning approach is based on the best practices outlined in IBM's structured IT methodology and guidelines for Enterprise Architecture Planning[1]. It consists of the following 7 major steps (See Figure 2-2):

- Business Architecture Model: This activity translates MDT business strategies into Enterprise Architecture goals, objectives, and strategies. Further it links the essential activities and information required to support MDT's defined goals, critical success factors, and performance measures. The process identifies the Information Technology business unit as a critical partner in Transit where IT plays a significant role in achieving continued business success.

[1] Steven H. Spewak and Steven C. Hill, *Enterprise Architecture Planning*, John Wiley & Sons, 1995.

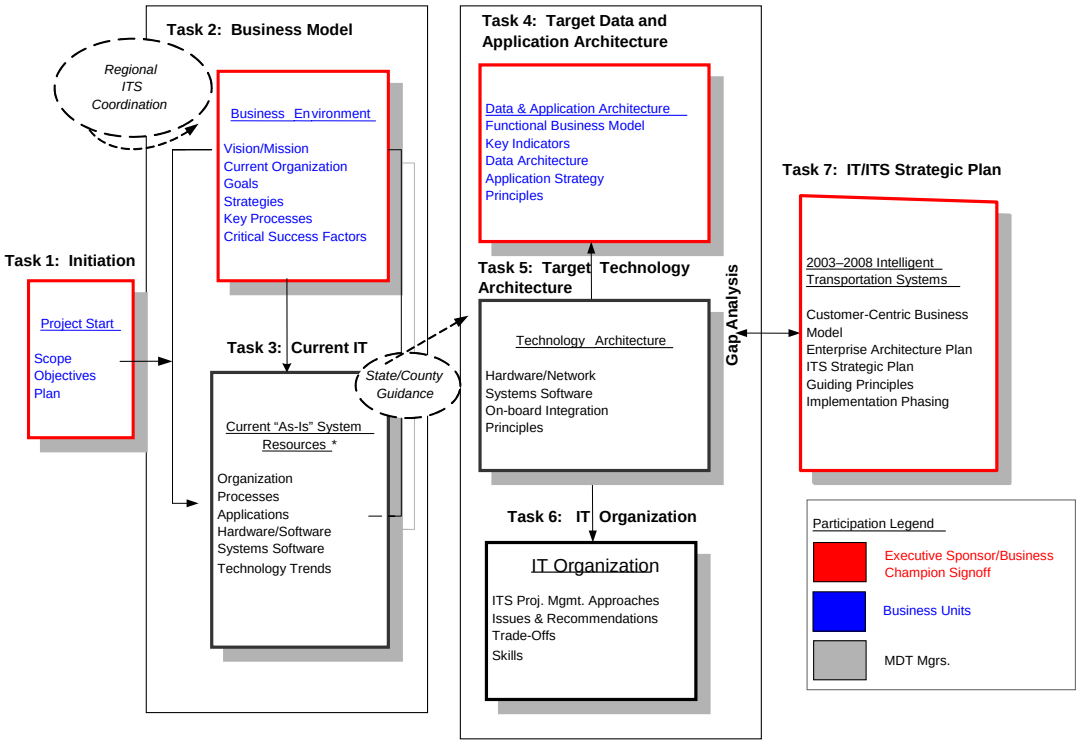
- Current IT / ITS Architecture Model: This activity documents the current IT environment, and is a high-level assessment of Miami-Dade Transit's current IT capabilities (e.g., data applications, hardware, software, networks, organization, and processes) to support the business. It is a baseline from which to develop the target IT Systems Architecture to support the business vision into the 2003–2008 planning period.

- Target IT / ITS Systems Architecture: Analysis and recommendations to develop high-level data, applications, and technology architectures required to support the MDT Business Architecture. This provides a gap analysis of the current vs. target IT environment, outlining tactical and strategic opportunities, and recommended next steps.

- IT Organization: Issues, best practices, and recommendations for the IT organization to support the Business Architecture.

- Final Strategic Plan: The final task will consolidate the four layers of the architecture planning process (business, data, applications, and technology) to enable the identification and reasoning of enterprise- and system-level integration concerns and investment decisions. The Final Strategic Plan provides unifying concepts, common terminology, principles, and common standards for resolving policy and management issues. It describes the transit enterprise information systems architecture and its components through the use of various architectural views and modeling techniques. Strategic initiatives are defined to support the Business Model, the Transit Goals, and IT Division's Goals, and are linked to Regional Architecture End-User Services where applicable to ensure compliance with the National ITS Architecture Policy.

Figure 2-2 IT/ITS Strategic Plan Methodology



The term "enterprise" is defined within the terms of the MDT organization, and is understood to transcend established organizational boundaries (e.g., external stakeholders, logistics). It should also be noted that EAP is in the process of *defining* (not *designing*) architectures for the use of information in support of the business and a high-level plan for implementing those architectures. The IT Strategic Plan development process, including the EAP process, will define the systems architectures; EAP does not design systems, databases, or networks. Thus, the plan does not call for the implementation of specific vendor systems. The design and implementation work is initiated after the EAP definition process has been completed. The selection of specific technologies and vendors is part of the analysis of technical and business requirements associated with a particular project.

In this strategic planning process, the Current or "As-Is" Architecture is described in the *Final Interim Report, July 15, 2003*. The process and components used to develop the future or Target Architecture are described in the *Logical Target Architecture Workshop Report, August 28, 2003* and the *Target Physical/Technical Architecture Workshop Report, September 2, 2003*. (Appendix B contains the full references to the three reports.) This Volume II document, the *2003–2008 IT/ITS Strategic Plan*, has been developed in the final task of the strategic planning process and is based on the work completed in the prior six tasks. Its purpose is to provide supplemental technical information to the *IT/ITS 2003–2008 Strategic Plan Summary*, Volume I.

3 INFORMATION TECHNOLOGY SERVICES

The Information Technology Services Division (IT Division) provides IT services to all of the business areas of MDT. The IT Division has made significant changes in the technology and services available to MDT. This chapter summarizes the many accomplishments of the IT Division that set the stage for moving forward, highlights comparisons against peer organizations that were completed by the Gartner Group, and identifies MDT's newly developed mission, vision, goals, guiding principles, and critical success factors.

3.1 IT Achievements

Over the last few years, the IT Division made significant improvements in the business environment for MDT and in the IT Division. A summary of the IT Division's accomplishments is included below. They were guided by the *MDT Information Technology Strategic Plan for Fiscal Years 2000 through 2002.* The accomplishments are grouped under the prior strategic plan's six goals. A summarized version of these accomplishments is included in Volume I, Section 3.

Goal #1: Y2K Readiness

- Successfully prepared for millennium impact on automated systems
  - Made required system changes
  - Transitioned successfully to the Year 2000
  - Created a Disaster Recovery Plan

Goal #2: Improved Network Infrastructure and Environment

- Provided enhanced voice and data communications services across MDT
  - Redesigned the voice and data communications infrastructure, implemented enhancements, and completed ongoing maintenance
  - Implemented Voice Mail at MDT
  - Implemented improved communications at the Central Garage and Coral Way with two voice switch projects
  - Expanded the LAN to rail stations, including Palmetto Station
  - Enhanced the network at Lehman Center
  - Completed the TDD / ADA Pay Phones Project

- Adopted Client / Server Technology and Extended Network Browser Capabilities
  - Expanded and improved network capacity with the NT Implementation Project
  - Installed 900 new personal computers (PCs)
  - Significantly expanded e-mail at MDT and migrated staff to one e-mail system via the Exchange Project which included converting thousands of user files
  - Completed the WEB Redesign Project
  - Completed Phase 1 of the CAD / AVL Enhancement Project
  - Began the feasibility study for the TOS Upgrade Project

- Developed the specifications and a RFP for the M3 Project
- Advanced the Metromover Automation Analysis Project to the implementation phase
- Completed the Paratransit GPS Assessment Project
- Initiated the Consumer Information Network Project that will provide trip planning via the Internet
- Acquired a Geographical Information System and built key data layers

Goal #3: Improved Application Infrastructure and Environment

- Deploy State-of-the-Art Document Control Center
  - Engineering Document Control Center Project is underway, starting with the "as-built" drawings
  - An Enterprise-wide Document Management System Project is in process for all of MDT

- Deploy State-of-the-Art Data Collection Tools
  - Acquired Oracle software as part of the DB Platform Conversion Project
  - Developed AVL ad hoc reporting via the web
  - Implemented various GIS analysis and reporting applications

- Develop an Enterprise Data Model and Summary Data Warehouse
  - Completed the Capital Plan — Phase II Project
  - Initiated Enterprise Data Modeling Project with preliminary guidance from Palisades Consulting Group
  - Began the planning phase of the Data Warehouse Project

- Adopt Standardized Application Architecture
  - Approach is being refined as part of the strategic planning effort
  - Completed migration of viable applications to Oracle

- Upgraded Vendor Supported Software/Hardware
  - Completed the Phase I CHOICE Upgrade to Oracle and Phase II is underway
  - Upgraded the Watermark Scanning Software
  - Completed upgrades to the PALS Project and coordinated with the county
  - Completed the Overtime Reporting System Conversion
  - Completed upgrades to the CIS project and is now in a conversion phase
  - TOS/Bops Interface Upgrade Project

- Provided Enhanced Government Reporting Tools
  - Supported National Transit Database compliance and began additional needs assessment

- Expanded Functionality / Accessibility of Profession-Specific Hardware / Software
  - Upgraded the BusFare System and improved its probes
  - Implemented an ID card with a contactless reader as part of the Transit SmartCard Project / Golden Passport Project
  - Planned and initiated a project to sell fare media on the Web
  - Planned and implemented a Bus Stop Inventory and built the Bus Stop layer in the GIS
  - Initiated a trip planning project in coordination with regional partners
  - Initiated the Metromover Automation Analysis Project
  - Provided laptop computers for field supervisors
  - Implemented two of the three Kiosk Projects, with the third underway
  - Initiated the planning phase for Automated Passenger Counters
  - Developed specifications and an RFP for automated fare collection
  - Completed the Electronic Signage RFP
  - Completed a wide range of projects such as the following:
    - DBE Contract System Project
    - Reduced Fare Permit Project
    - Fueling System Implementation Project
    - Graphical Scheduling System Project
    - Daily Logs Project
    - Disciplinary Action Reports Project
    - SOTA printer / scanner Deployment Project
    - Random Drug Testing System Conversion Project
    - PACE Evaluation and Conversion
    - Rail Computer / Central Control
    - WEB Redesign Project
    - M3 Project
    - TOS Bus Interface
    - TRI (Phase II) / TEA Enhancements

Goal #4: Timely and Consistent IT Service

- Implement a Quality Assurance (QA) Function for IT
  - Developed a budget proposal for a QA function
  - Began posting policies and procedures on Intranet
  - Developed improvement strategies in strategic planning effort

- Review and Adopt New Performance Measures for IT Services and Deliverables
  - Hired Gartner Group to assist with performance measures and QA

- Provide More Timely and Consistent IT Services
  - Redesigned approach for providing desktop support
  - Expanded Call Center support hours

- Improved Call Center performance by implementing new procedures and by adding a Call Center website for customers
- Completed Core Needs Analysis during strategic planning effort

Goal #5: Efficient Management of IT Resources

- Adopted Standard Application Tool Set
  - Adopted key standards and acquired Oracle, SQL, JAVA, Oracle Developer, and other standard tools

- Implemented Cost Control Measures
  - Acquired resources to help manage costs
  - Implemented new budget planning and management procedures
  - Improved budget and cost controls; reduced duplicated costs

- Established Formal Data Retention/Recovery Policies
  - Developed data retention and data recovery policies

- Adopted Standardized Business Analysis and Cost/Benefit Analysis Procedures
  - Worked with FTA to obtain free ITS Architecture Assessment and technical support
  - Developed plan and acquired resources for a 2003–2008 IT/ITS Strategic Plan
  - Initiated the use of Project Charters to improve project implementations
  - Working with consultants to improve business practices
  - Completed Core Needs Analysis Project
  - Developed procedures for the Information Technology Services Procedures Manual Project
  - Identified user needs and developed the RFP for improving resource management with the M3 Project
  - Developed an automated planning and project tracking system
  - Increased efficiency by implementing Voice Mail
  - Began Contract Database Analysis Project

Goal #6: Technical Training for All End-Users and ITS Staff

- Adopt an Aggressive Employee Development and Technology Training Program
  - Implemented a Tech Training Program with ITD and Human Resources
  - Provided training to MDT staff on basic computing skills, Word, Outlook, and other new systems
  - Provided technical training to IT staff on GIS, LAN support skills, and other new tools
  - Provided Oracle training for IT staff

3.2 Gartner Group Rapid Assessment for Total IT Expenditure

This chapter contains an expanded summary of the Gartner Group Rapid Assessment that provides more detail than in Volume One of the IT/ITS Strategic Plan. MDT's IT Division engaged the Gartner Group to complete a rapid assessment of MDT's IT environment, focusing on cost efficiency observations and the alignment of IT and the Business. The intent was to find areas for IT to improve and to understand its cost performance relative to other enterprises with similar workloads, complexity, and performance characteristics.

The Gartner assessment activity was also designed to serve as a baseline for the IT Division. It establishes a preliminary set of performance measures that the IT Division can measure going forward, and provides a better understand of how to gather performance measures in a consistent manner. The IT Division intends to develop and implement additional ongoing performance measurements that would be helpful in monitoring and improving IT service provision.

3.2.1 Efficiency Observations

The preliminary *Gartner Measurement Report: Rapid Assessment for Total IT Expenditure* (June, 2003) provides benchmark statistics for MDT's IT Division in the following seven IT functional areas:

- IT Help Desk
- Distributed Computing
- Midrange Computing
- Wide-Area Data Network
- Voice Technology
- Applications Development
- Applications Support

The results indicated that when MDT was compared to the composite peer group:

- MDT's Total Cost by Technical Area was significantly lower overall and was lower on eight of the ten technical areas measured.
- MDT's Total Cost by IS component (Outsourcer, Disaster Recover, Transmission, Personnel, Software, and Hardware) was lower than that of the peer group.
- The 32.2 Total Full Time Equivalents (FTEs) in the MDT IT Division were significantly less than the total for the peer group (42.6 FTEs) for the IT functional areas that were assessed.

The Gartner Group's good cost efficiency findings, coupled with the above average customer satisfaction ratings discussed below, indicate that the IT Division has done remarkably well in the past with tight budget and FTE resources. The new challenges of significant transit service, departmental growth, and the need to update or replace old legacy systems will require the addition of new IT staff to the division to meet MDT's growing business needs. This is particularly true given the current staffing levels that are below those of comparable peers.

3.2.2 IT/Business Alignment

The second portion of the Gartner Group assessment focused on the alignment of the IT Division and the Lines of Business (LOBs). Surveys assessing the rated importance and satisfaction of the 14 IT services and four components of IT deliverables, shown in Table 3-1, were completed by both IT staff and by staff in the LOBs.

Table 3-1 Areas Rated for Importance and Satisfaction by IT and the LOBs

Areas Rated for Importance and Satisfaction	
IT Services	**Components of IT Deliverables**
Desktop Environment / Infrastructure	Content
IT Planning / Standards	Quality
End User Support / Services	Timeliness
Large-Scale Processing	Cost
Applications Development	
Applications Support	
Communications Infrastructure / Services	
Internet Capabilities / Access	
Intranet Services	
Negotiations / Procurement	
Electronics Linkages to Customers / Partners	
Project / Data Management	
Multimedia Operations and Development	
Security and Disaster Recovery	

The Gartner Group compared the importance and satisfaction ratings of the IT staff and the LOBs to see how well they were aligned in their perceptions and ratings of the services and deliverables. According to the Gartner report, "Overall the department participants responding to the survey indicated a higher level of both Importance and Satisfaction than MDT ITS perceive with the services provided by MDT ITS." For example, the combined Importance ratings of the LOB respondents were all 4.0 or higher for each of the 14 IT Service areas (on a five-point scale where 5 is Extremely Important), while the IT staff rated seven of the IT Service areas between 3.0 and 4.0. The users in the LOBs also rated their Satisfaction with the IT Services higher than did the IT staff.

The survey was helpful in highlighting the importance to the users of the different IT services. In particular, the survey findings serve as a baseline for future assessments of progress in meeting the IT needs of the customers. The development over time of more performance measures in the various IT service areas will also help the organization track its performance and customer satisfaction.

3.3 IT Mission, Values, and Vision

As a part of this strategic planning effort, the IT Division updated its mission, values, and vision after an assessment of the business needs of MDT and the current operating environment. The IT Division's mission is shown below.

MISSION: *Promote the improvement of Transit's performance through the application of technology and technical support services.*

The values of the IT Division, shown below, reflect the commitment of the IT staff to a customer and business focus, teamwork, and accountability, among other values.

VALUES:

- ✓ *We understand and enhance our clients' business operations*
- ✓ *We proactively make things happen and seek opportunities for improvement*
- ✓ *We cooperate and work well with teammates, clients, and business partners*
- ✓ *We progressively innovate while maintaining a stable operating environment*
- ✓ *We are dependable and follow through on commitments*
- ✓ *We accept accountability to educate ourselves and maintain superior technical skills*

The five-year vision statement was also developed by the IT Division management and senior staff in July 2003. It is included below.

VISION:

- ✓ *The five-year vision of the Information Technology Services Division is to provide reliable, cost-effective services that meet customer expectations*
- ✓ *Key services to be provided include:*
- ✓ *Systems and tools to solve the customer's business needs*
- ✓ *Easy to access data that is accurate, secure, and integrated enterprise-wide*
- ✓ *Fast access to customer information, including real-time data, via multiple modes*
- ✓ *The team will implement integrated systems and data, using standards, to improve data access, usability, maintainability and costs*
- ✓ *The team will operate using good guiding principles and business practices*
- ✓ *The services will be provided by motivated, happy, innovative employees who are skilled, caring, and customer oriented*

3.4 IT Technology Guiding Principles

3.4.1 Introduction

IT Technology Guiding Principles provide a common understanding needed by the MDT IT group to assist the decision-making process for:

- Technical strategies for distributing data and applications
- Strategies for designing and implementing systems
- Build versus buy
- Define conceptual configuration or vision of the technology environment using principles and platforms agreed upon, i.e., mainframe as enterprise server, 2-tier, 3-tier, N-tier models
- Define conceptual locations for storing data and executing applications, e.g., conceptual distribution models
- Support for current and future business locations
- Implementation of vendor technology platforms

3.4.2 Key Factors Driving IT Technology Guiding Principles

Key factors drive the development of MDT IT Technology Guiding Principles. Factors include the consideration of the MDT business environment, direction and organization, generally accepted computing principles or "best practice," the analyses of the current MDT computing environment, and the Target Technical Architecture.

The IT Technology Guiding Principles adopted by the MDT IT Division are based on Transit business needs and focus on the IT / ITS technology strategy. The principles represent ITS basic technical philosophies that address:

- Political / geographical / regional / organizational characteristics
- Organization emphasis on the amount of data or access time
- Strategic direction of projects — performance, cost reduction, accuracy, speed to market, or older technology
- Strategic direction of technology (e.g., use of client / server)

The IT Technology Guiding Principles are closely tied to the MDT IT Division's Vision, the role of the MDT IT Division in the region, and the need to prepare for rapidly expanding transit services as defined in the People's Transportation Plan (PTP). The MDT IT Division's Vision describes where the organization wants to be in the future. The IT Technology Guiding Principles will define how the MDT IT organization wants to get there.

Additional considerations of the MDT business environment that would impact the adoption of MDT IT Technology Guiding Principles are summarized in Table 3-2.

Table 3-2 Considerations Impacting MDT IT Technology Guiding Principles

#	Consideration	Description
1	Regional Integration	County goals for multimodal regional transit
2	Geographical distribution	Business functions are spread over several different sites; expansion to new sites is planned.
3	Centralization of services vs. local autonomy	Ability of local sites to be able to operate independently from the central organization.
4	Performance	Business improvement goals as measured by service and ridership, and by technical improvement goals as measured by response time and/or batch throughput.
5	Scalability	Plans for services expansion (PTP) and use of ITS has caused volume of data to expand, and volume of processing to increase.
6	Mobility	Business functions require workers to have access to corporate information even when they are out of the office or unable to connect to the corporate network.
7	Multiple distribution channels	New Transit services will provide customer information through a variety of communication devices.
8	Currency	Business requirements for freshness of some data will indicate that real-time or close-to-real time data currency is necessary.

3.4.3 MDT IT Technology Guiding Principles

The MDT IT Technology Guiding Principles relevant to the organization's business and technical strategies are listed below in Table 3-3. The IT Guiding Principles support MDT Mission, Vision, and Goals. The IT Guiding Principles establish the basis for governance and implementation of the IT/ITS Strategic Plan and architectures, and affect development, maintenance, and selection of technologies.

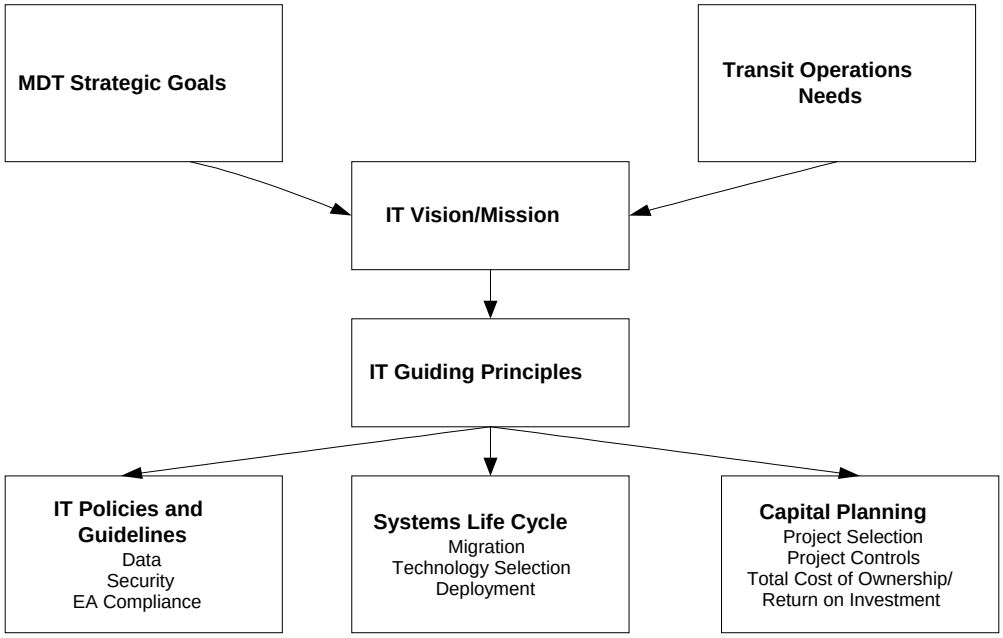
Table 3-3 MDT IT Technology Guiding Principles

1. Data will be owned, shared, and controlled as a Transit asset.
2. Applications will be developed using a cooperative process.
3. Application initiatives will be guided by an established methodology using a systems engineering approach.
4. Technology infrastructure will be developed to facilitate integration of data and systems.
5. Secure network architectures will be employed.
6. IT will focus on and be measured by the value of solutions delivered to internal and external stakeholders, as well as Transit customers.
7. IT will be a partner in reengineering and improving business processes related to IT systems.
8. IT will adhere to national and regional standards for Transit architecture.
9. IT will insure recoverability to protect the continuation of the business.

10.	Apply open systems concepts to insure portability, scalability, interoperability, and compatibility of information technology systems.

IT Policies and Guidelines, the Systems Life Cycle Development, and the Capital Process are impacted by the actions driven by the IT Guiding Principles, as illustrated in Figure 3-1. Explicit standards-oriented policies and guidelines have been developed in compliance with these principles and are included in the remainder of this document.

Figure 3-1 Role of IT Guiding Principles



3.5 IT Goals and Objectives

The Information Technology Services Division adopted the following seven goals, with their objectives, to guide the division over the 2003–2008 time period. Each year the goals and objectives will be refined to reflect changes in business needs and the operating environment.

Goal #1: Enhance Customer Information through Technology

Objectives:

- Expand access to passenger information (e.g., through wireless technology, internet, kiosks)
- Allow Transit customers to purchase fare media through Web technology
- Improve the provision of regional trip planning information
- Provide on-board transit information and integrated stop announcements
- Provide Transit customers with real-time next bus / train information
- Provide Paratransit customers with enhanced trip and routing information

Goal #2: Improve Business Tools and Access to Information for Management and Staff

Objectives:

- Expand functionality and accessibility of profession specific hardware/software, such as the Transit Operating System (TOS)
- Deploy state-of-the-art document control center and related tools
- Deploy state-of-the-art data management tools and improve data collection, storage, access, integration, analysis, and reporting
- Develop enterprise-wide summary data warehouse(s), including an agency-wide source of geographical data

Goal #3: Upgrade and Standardize Transit's Information Technology Environment

Objectives:

- Implement ongoing maintenance and enhancements
- Develop an enterprise data model and ITS architecture
- Implement a standardized database environment and application architecture
- Refine and adopt an electronic communication policy and standard for Transit
- Provide enhanced voice and data communication services across Transit, including adoption of browser-based technology
- Upgrade and standardize equipment agency-wide
- Implement an improved application infrastructure and environment

Goal #4: Improve the Management of IT Resources and Processes, Including Communications with Business Functions

Objectives:

- Be a valuable partner in reengineering and improving business processes as systems are improved
- Institute a formal approach to the creation of all Information Technology projects
- Increase Transit's reporting tools, including development of tracking systems to assist management with employee performance
- Improve IT quality assurance function
- Improve performance measures for IT services and deliverables
- Implement improved cost control measures
- Adopt standardized business analysis and cost benefit analysis procedures

Goal #5: Improve Services and Operating Efficiency through On-Board Vehicle Technology Improvements

Objectives:

- Implement on-board architecture, on-board systems, and necessary modifications in partnership with other stakeholders to support Transit needs
- Enhance field communications to central control through technology
- Improve quality and availability of real-time information

- Support integration between on-board ITS applications, field equipment, and central computers for increased information and reduction of costs

Goal #6: Enhance Safety and Security through Technology

Objectives

- Improve passenger safety and security through on-board video surveillance and real-time information capabilities
- Enhance systems that capture incident and accident information for more accurate reporting
- Provide enhanced analysis and reporting tools to improve and ensure customer safety
- Integrate voice annunciation with digital display to comply with ADA requirements

Goal #7: Improve Skills and Effectiveness of Staff through Training Program Enhancements

Objectives:

- Provide project management and needed technical training for IT Services staff
- Support training for business area staff and system users when a new system is implemented
- Support agency-wide training efforts, such as creating a web-based training program for MDT employees

3.6 IT Critical Success Factors

The management and senior staff of the IT Division identified factors that need to be in place which are critical for the success of the IT Division as it strives to achieve its vision and goals. A summary of the key critical success factors is included below. The first four critical success factors in the list were cited as being extremely important by many of the staff.

- Staff resources
- Financial resources for capital projects and operations and maintenance
- Training, including technical and project management
- Executive Leadership / Line Management support
- Enterprise-wide and "customer-centric" view
- Transition management as the organization and the technologies change
- Modernization of the systems environment
- Core data management
- Planning and prioritization by MDT management

4 BUSINESS ARCHITECTURE

The Business Architecture layer of the EAP process provides the understanding of the existing business practices, basic business operations, and functionality. It is the result of understanding Transit's strategic business objectives, and provides the baseline for understanding the information needed to support business, what applications are needed to provide the information, and what technology is needed to support the applications.

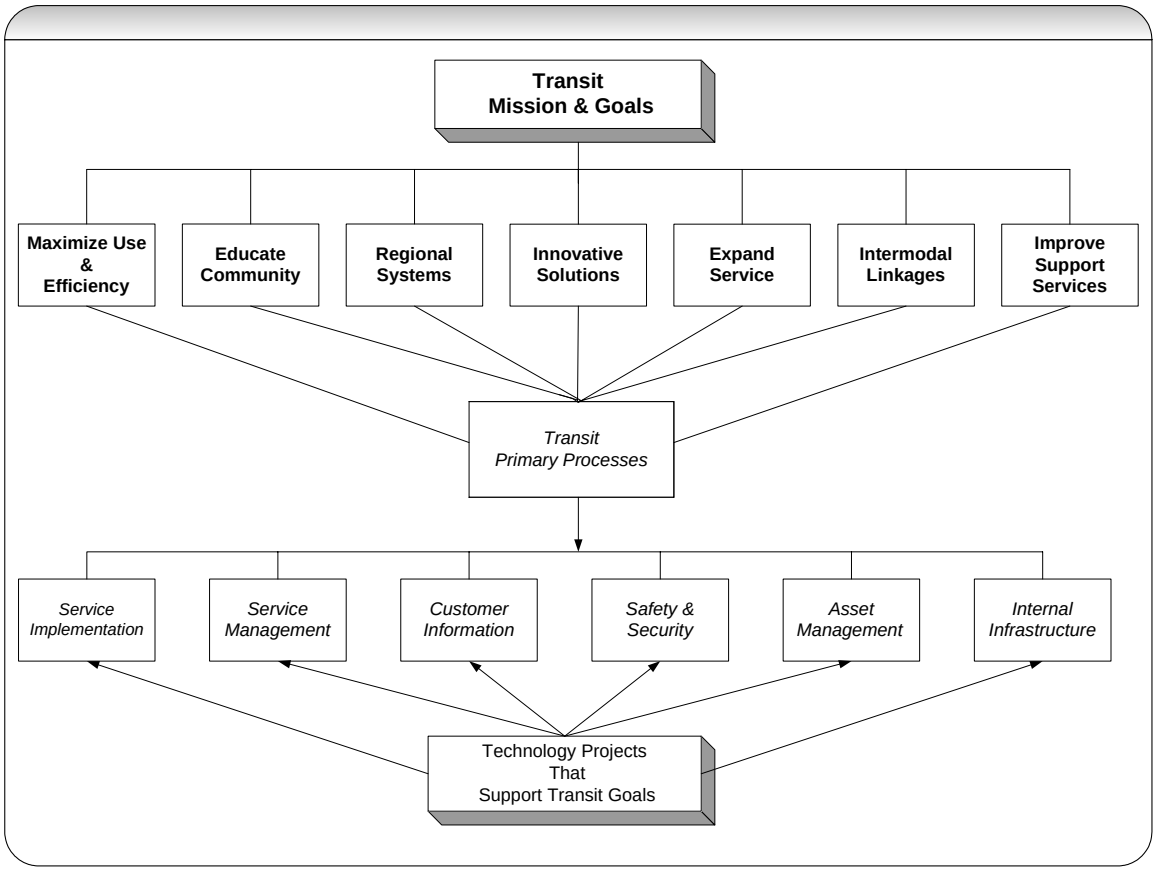
Necessary to the development of the Business Architecture is important background information and discussion on MDT's business environment and goals, and the six primary processes. This background information and discussion are included in Volume One, the *IT/ITS 2003–2008 Strategic Plan Summary*, and in the *Interim Report*.

The six transit priority processes shown in Figure 4.1, Service Implementation, Service Management, Customer Information, Safety and Security, Asset Management, and Internal Infrastructure, form part of the framework for developing and describing the Data and Application Architecture. In addition, the role of technology in improving these six key transit processes is described in Section 1.3 of Volume One of the *IT/ITS Strategic Plan*.

The mission, vision, goal, and guiding principles of the Information Services Division also were developed in support of MDT's business needs and the Business Architecture.

As business roles change, information and information flow can also change. The business architecture is an evolving tool that the IT Division will use to identify and support these changing processes.

Figure 4-1 The MDT Business Architecture Framework — Six Primary Business Processes



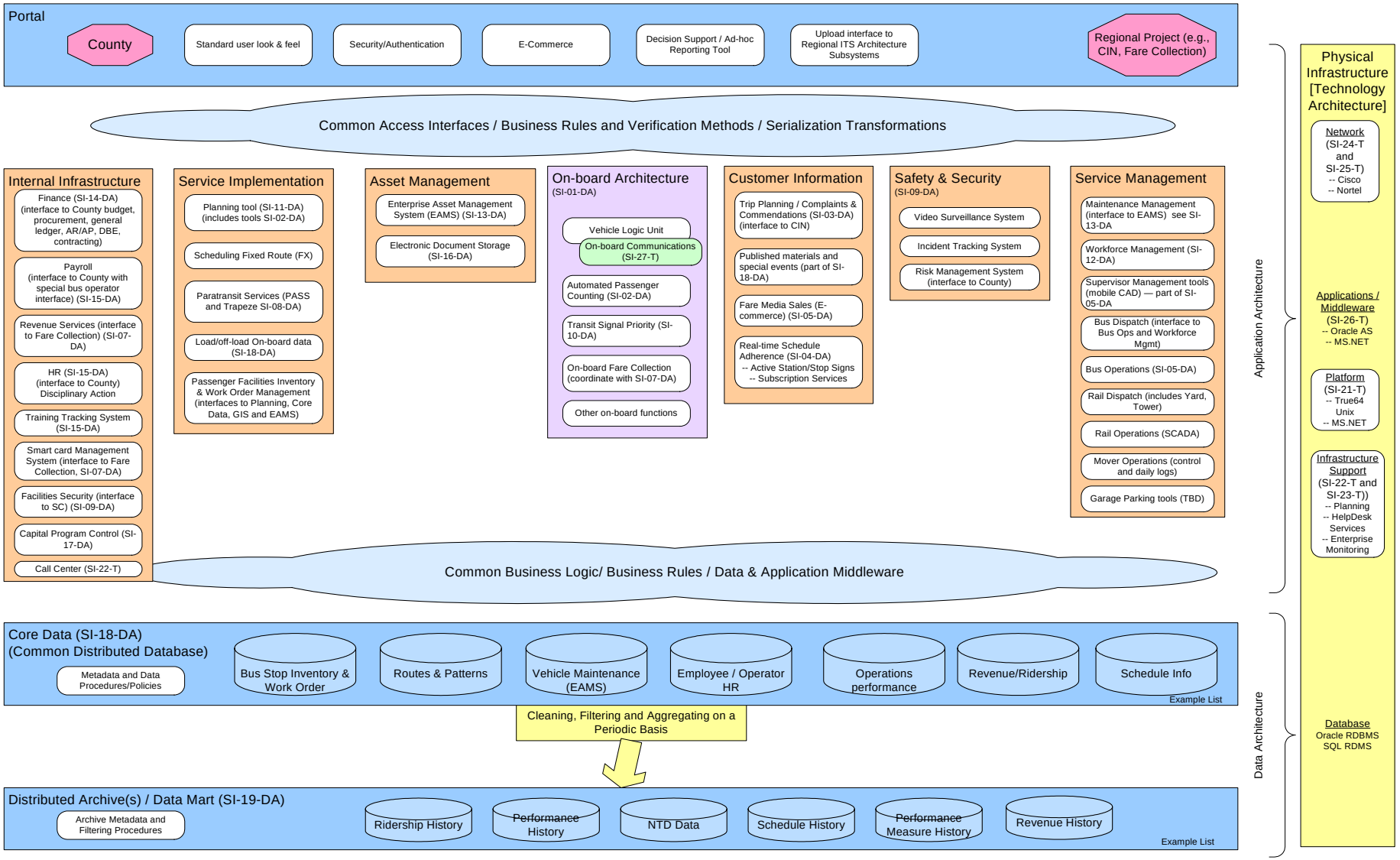
5 TARGET ENTERPRISE ARCHITECTURE — THE ROADMAP AHEAD

The Target Enterprise Architecture provides the initial concept of information systems and the linkages between them. It is made up of key information systems, systems boundaries, enterprise data hubs, data flows, data standards that integrate those information systems, and the surrounding hardware/software and networks.

The conceptual view of the overall MDT Target 2003–2008 Enterprise Architecture is depicted in Figure 5-1. It is further broken down into the 3 layers (Data, Application, and Technology), and each layer is notated with a unique identifier that links it to a strategic initiative described in Chapter 12.

The Data and Application initiatives are supported and contained within the Technology initiatives. This is depicted by the vertical bar listed as "Physical Infrastructure." The "Portal" includes key stakeholder access and dissemination methods, including policies and security related to information. For example, a report generator supports all the "transit enterprise" and provides access to data created, analyzed, and aggregated to all transit users (people and other applications).

Figure 5-1 MDT Target 2003–2008 Enterprise Architecture



6 DATA AND APPLICATION ARCHITECTURE

6.1 Introduction

The MDT Data and Application Architecture is a tool for people who are designing and building systems to meet MDT business goals and deliver Transit services. The architecture does not prescribe technologies, designs, or policies; rather, it provides a framework to illustrate the data and applications, and their relationship to each other, within the Miami-Dade and southeastern Florida transportation network. Particularly since the operating environment at MDT is constantly changing, the framework will also need to evolve and grow to meet the continuing demands of the organization.

The Data and Application architecture addresses the question of what applications and data management systems should be in place to support MDT's business goals and vision. As a centerpiece of its goals, MDT must engage in an aggressive plan to meet the PTP over the next three to five years. Many data and application subsystems will need upgrade, migration, or replacement in order to achieve the productivity from staff and resources, provide effective tools to plan and assess performance, and grow customer and stakeholder services to meet these goals. The Data and Application Architecture touches every unit, division, garage, pickup point, and vehicle within MDT; its scope is the enterprise.

The architecture also includes regional, county, and state stakeholders who share data and coordinate services with MDT. Decisions by these organizations will impact MDT; in particular, their influence will affect data and application dependencies, and links between MDT and the aforementioned stakeholders.

This section provides a brief management introduction, an overview of what the IT Division is trying to achieve in its technical recommendations and plans for data management and applications. Specific initiatives will be listed in the plan that will support the development of an enterprise-wide approach to data management and applications. The details of the Data and Application Architectures are found in the accompanying document, *Technical Appendix A: Data and Application Architecture Detail*, dated January 3, 2004.

6.2 Strategic Approaches

- **Strategic Approach #1: Centralize and manage core data**

Significant obstacles arise when systems are built independently, without consideration of how an application fits into the overall information enterprise, what data it shares with other systems and applications, and how it supports business processes. **Core data**, such as bus stops or operator ID numbers, are used by a wide variety of Transit systems and business functions. Core data becomes an enterprise asset, and as such, principles should be established to manage that asset. The six key principles are:

- Avoid duplicating the development and maintenance of data and data sets
- For a core data element, establish a single point of management, collection, "cleaning," and define an authority or a system of record to ensure data consistency and completeness throughout the organization

- Create enterprise awareness of critical data (understand processes that depend on data)
- Create an awareness of the value and cost of data throughout the organization
- When creating core data, determine priority order based on overall criticality to application, operations, and the number of users
- Consider security, including access requirements and restrictions

Strategic Approach #2: **Develop corporate-wide data and interface policies prior to building the "enterprise information infrastructure"**
MDT identified data management procedures and practices that should be implemented as part of building an enterprise information infrastructure. These procedures and practices follow from the principles of core data and help fill in the gap.

- Identify and implement standard data access methods
- Develop a data dictionary of core data definitions (including standard naming conventions)
- Develop and document Metadata for core data sets
- Manage data life cycle
  - Identify life cycle processes, update frequencies, etc.
  - Archive old versions of data
  - Document transformation rules for data sets
  - Synchronize schedule data updates and configuration of management procedures
- Develop and disseminate standard code lists (e.g., incident classifications)
- Document relationships (dependencies) among data sets
- Assign data stewards for core data from among line staff
- Standardize on a set of file formats (e.g., JPG, doc, XML, etc.)
- Manage user access and security
- Develop GUI style standards and reporting formats
- Define and manage security requirements

Implementation of these procedures and practices will support MDT's goal to move to purchasing Commercial Off-the-Shelf (COTS) tools. The adoption of standard methods and procedures will support implementing a quality process. Incorporation of transit industry and information technology standards for data such as Transit Communications Interface Profiles (TCIP) and XML will minimize customization requirements needed by new Transit software and enable integration with existing applications and data management systems. Development of a standard data dictionary that supports areas not covered by TCIP will support internal data integration needs.

Strategic Approach #3: Enforce a strong systems engineering approach to applications acquisitions
In addition to being mandated as part of the FTA National ITS Architecture Policy on Transit Projects, a systems engineering approach benefits effective deployment of information technologies. Systems engineering is defined by the FTA as "…an interdisciplinary collaborative approach to derive, evolve, and verify a life cycle balanced

system solution that satisfies customer expectations and meets public acceptability." The policy describes the following systems engineering process elements (per www.its.dot.gov/aconform/Arch2a.htm):

- Identification of applicable (internal and) regional architecture portions
- Identification of agencies and roles (key stakeholders)
- Requirements analysis and specification
- Identification of relevant ITS (and IT) standards and test procedures
- Alternatives analysis to meet requirements
- Procurement options
- System operations and management procedures and resources
- Maintenance and update procedures and resources

The initiatives described below tend to be interdisciplinary and multifaceted. A systems engineering approach provides for a step-by-step approach that uncovers potential schedule delays and cost overruns as typically occurs with complex IT projects.

6.3 Relationship of Data and Architecture Subsystems to Primary Processes

The information environment in which a transit agency works is complex by nature. The complexity may be generalized by categorizing business areas into six primary processes (see Figure 4-1) as described in Chapter 4. These primary processes represent major functions that constitute the MDT's business environment. The major functions are contained within the subsystems (data and applications) that are depicted in the application and data architecture.

The enabling foundation of the subsystems, and by generalization the primary processes, is the core transit data. Core transit data are the datasets that need to be implemented in order to allow the implementation of applications that are requested by MDT users and key stakeholders. In Figure 6-1, this dependency is depicted by the center piece that binds all the primary processes (and their users) and stakeholders together.

Figure 6-1 Figure Primary Processes and Key Stakeholders

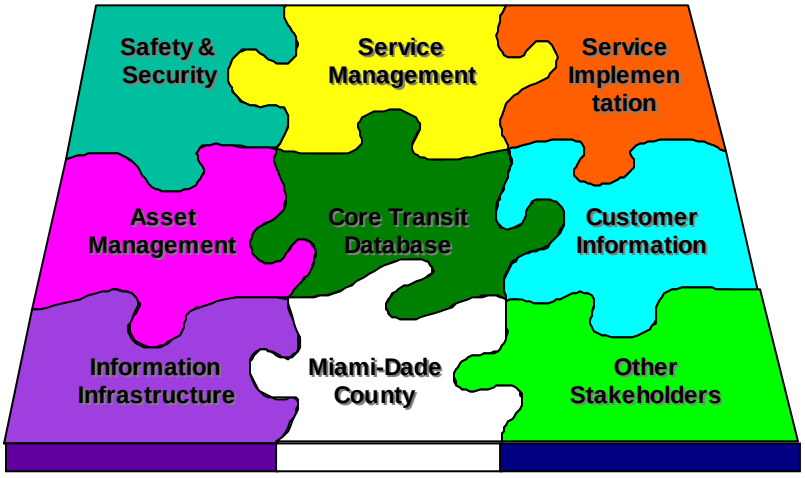


Table 6-1 shows the relationship among primary processes, major functions, and subsystems. The subsystems are the elements that are depicted in the Data and Application Architecture diagrams.

Table 6-1 Primary Processes with Major Functions and Subsystems

Primary Processes	Target Major Functions	Applications
Internal Infrastructure	▪ Financial management* ▪ Manage human resources* ▪ Manage payroll ▪ Manage revenue services* ▪ Manage smart card ▪ Manage user technology	▪ Finance (interfaces to county) ▪ Payroll (interfaces to county) ▪ Revenue Services (coordinated with Fare Collection) ▪ HR (interface to county) including Disciplinary Action ▪ Training Tracking ▪ Smart card management (coordinated with Fare Collection, HR, and Facilities Management / Security) ▪ Capital Program Control ▪ Call Center
Asset Management	▪ Manage assets	▪ EAMS
Service Implementation	▪ Manage passenger facilities ▪ Plan service ▪ Plan on-board configuration / performance data ▪ Schedule fixed route service ▪ Manage paratransit services* (certification, reservations, scheduling, dispatch, billing, and complaint / commendation)	▪ Planning Tools (for analyzing performance) ▪ Scheduling (Fixed Route) ▪ Paratransit tool suite (Trapeze) ▪ Passenger Facilities Inventory and Work Order (interface to EAMS, GIS, Trapeze) ▪ Loading and off-loading on-board data (includes preparation and dissemination)
Service Management	▪ General o Manage maintenance o Manage operations workforce o Field Supervisor Management o Manage communications o Manage on-board vehicle systems ▪ Bus o Manage bus dispatch	▪ Maintenance management (interface to EAMS) ▪ Workforce management (for all mode operator and maintenance) ▪ Supervisor management tools ▪ Bus dispatch (with interface to workforce management data) ▪ Bus operations (with interface to RT on-

Primary Processes	Target Major Functions	Applications
	o Manage bus operations o Garage (parking) management ▪ Rail & Mover o Manage rail dispatch o Manage rail operations o Manage mover operations ▪ Paratransit* o *Manage paratransit operations (contracted out)	board, workforce, and dispatch data) ▪ Rail dispatch (includes control, yard, and tower) ▪ Rail operations ▪ Mover operations (upgrade underway) ▪ Garage parking tools (e.g., for managing APC equipped vehicles)
Customer Information	▪ Provide customer information	▪ Trip Planning (INFO), Complaints/Commendations (COM) with interface to CIN ▪ Published material and special events ▪ Fare Media Sales (e-commerce) ▪ Real-time information (active stop signs /subscription services)
Safety and Security	▪ Manage incidents ▪ Manage video surveillance*	▪ Incident tracking system ▪ Video surveillance system (upgrade) ▪ Risk management (interface to county)

6.4 Strategic Initiative Discussion

Over 30 major (suites of) applications fall within the MDT information enterprise. These systems provide the data and services required to meet the business needs as articulated by MDT goals (see Chapter 2). The nineteen (19) Data and Application initiatives (Table 6-2) address the concerns related to the emerging applications as well as those that currently exist. The content of the initiatives is discussed in Chapter 6.4.

Table 6-2 Data and Application Initiatives

Number	Name
SI-01-DA	On-Board Bus Infrastructure and Replacement
SI-02-DA	Automated Passenger Counting
SI-03-DA	Customer Information Network
SI-04-DA	Real-Time Information
SI-05-DA	Bus Traffic Control Management
SI-06-DA	E-commerce
SI-07-DA	Fare Collection
SI-08-DA	Paratransit
SI-09-DA	Safety and Security
SI-10-DA	Traffic Signal Prioritization (TSP)
SI-11-DA	Scheduling Enhancements and Planning Tools
SI-12-DA	Workforce Management (TOS replacement)
SI-13-DA	EAMS — Materials Asset Management / Procurement
SI-14-DA	Finance (GL / AP / AR)
SI-15-DA	HR (Training, Payroll, Employee Information)
SI-16-DA	Electronic Document Storage
SI-17-DA	Capital Project Control
SI-18-DA	Core Data Management
SI-19-DA	Decision Support Tool / Datamart

With respect to the existing applications, Finance, Human Resources, and Safety and Security, existing interfaces to the county systems must be continuously maintained and upgraded. Coordination with the County Information Technology Department (ITD) should be nurtured to develop effective interfaces with county software systems.

The Data Initiatives (Core Data Management and Decision Support Tool) support all units and divisions across Transit. These initiatives provide for a single approach to report generation, data access, timeliness, and availability. Most other applications depend on the Data initiatives being in place prior to their effective deployment. Many transit agencies deploy information-driven applications only to wait or turn off their systems because the datasets that drive the applications are not ready or cannot be maintained.

These initiatives are critical to the success of the other initiatives and to meeting MDT mission and goals.

The other initiatives include deployment of new or upgraded systems. Some of them are at the later stages of implementation; however, many of them are in the early to mid-stage of planning. The initiatives emphasize planning: planning to meet user needs, planning for data operating and maintenance requirement, planning for data archiving, and planning technology alternatives and productivity baselines.

A robust systems engineering approach will support the planning efforts. MDT supports a systems engineering approach in planning and implementing projects, yet this approach must be enforced through implemented processes. The Data and Application and Technology Architectures initiatives and guiding principles discuss in more detail processes that may be implemented to improve and enforce systems engineering practices.

7 ON-BOARD ARCHITECTURE

The On-Board Architecture is presented here separately for emphasis, because in many transit agencies, the planning and integration that are needed to ensure the necessary and efficient flow of data between the on-board and the back-office environments has not occurred. Often, it has fallen between the cracks of the IT organization, the bus procurement group, vehicle maintenance, and engineering. The on-board architecture should be tied to both the Data and Application and Technology architectures. To this end, the on-board initiatives are divided into data and application and technology initiatives where On-Board Infrastructure and Replacement (SI-01-DA) is grouped with the Data and Application initiatives and the wireless communications efforts are grouped into a category called On-Board Technology (SI-27-T). The rationale behind this approach is to ensure close coordination with the on-board and back-office applications and data management systems. The communication technologies, like technology in general, are enablers of these data and application subsystems.

The On-Board Architecture and initiatives must be driven by an enterprise-wide perspective and not by the "first ITS project on the bus" mindset. Above all, multidisciplinary and cross-organization coordination and skills are needed for the success of ITS applications with on-board components.

The details of the On-Board Architecture may be found in both the Data and Application and Technology Architecture appendices to this report (Technical Appendices A and B) to emphasize the overlap and critical niche it possesses in the enterprise.

7.1 Introduction

The On-Board Vehicle Data and Application Architecture describes applications and data supported on-board the transit vehicle. The Subsystems supported by the On-Board Vehicle are listed in Table 7-1.

In principle, the logical processes supported by the on-board Metrobus functions should be similar if not identical to ones described for the Metrorail and Metromover. Because the various vehicle modes employ different operating procedures, control, and physical environment, implementation of the physical devices and components will not be identical. In procuring the actual systems, MDT may wish to procure systems that are similar in functionality, although they may not be similar in the technologies supported by their environments.

Table 7-1 On-Board Vehicle Subsystem Architecture

On-Board Subsystems	Processes Supported	Devices
Vehicle Logic Unit (VLU)	Manage security subsystems and alarms (includes AVM) Determine location (AVL) Manage schedule and route adherence Log health / performance data Load / manage component configuration and service data Manage communications (radio / wayside)	Processor Navigation unit (including GPS) Storage device Silent alarm VAN connector Radio connector Wayside (short-range communications) connector Trip recorder(s) with connectors to drive train and / or I / O controller
Automated Passenger Counting (APC)	• Monitor ridership • Monitor on-time performance (this function may be implemented in APC or the VLU, but *not* in both)	• Door sensors • Processor (may be co-located in VLU) • VAN connector
Manage On-Board Customer Information	• interior / exterior announcements • interior / exterior signs • Headsigns • Manage PA system	(interior and external) PA system (speakers, sensors, microphone) Headsigns Interior and exterior signs VAN connector Storage Processor (may be co-located on VLU)
Automate Fare Collection System	• Manage fare collection • Manage smart card reader • Manage operator logon	• Smart Card reader • Control head (console) • Cash box • Fare Collection Unit • VAN connector
Operator Console	• Manage Operator Interface (driver display)	• Console • Keyboard and touch screen • VAN connector
Video Surveillance	▪ Record Video Surveillance	▪ Surveillance system ▪ 4-5 video cameras ▪ Storage ▪ VAN connector ▪ Wayside connector
Transit Signal Priority (TSP)	▪ Manage Transit Signal Priority (TSP)	▪ TSP transceiver or wayside connector (depends on Traffic Operator equipment requirements)

On-Board Subsystems	Processes Supported	Devices
Vehicle ID	▪ Provide vehicle identification	▪ Vehicle ID
TV	▪ Manage On-Board TV	▪ TV console and subsystem ▪ VAN connector

7.2 Strategic Approaches

- **Strategic Approach #1: Enterprise-Wide Perspective**

The On-Board Architecture and initiatives must be driven by an enterprise-wide perspective. Above all, multi-disciplinary and cross-organization coordination and skills are needed for the success of ITS applications with on-board components.

- **Strategic Approach #2: Coordination of On-Board Technology with Fixed-End Systems**

The On-Board Technology Architecture deals with communications technologies that connect the on-board vehicle subsystem to the fixed-end, back-office systems. The design and implementation of these communications technologies must be coordinated with the IT Division to meet the data and information needs of the IT systems.

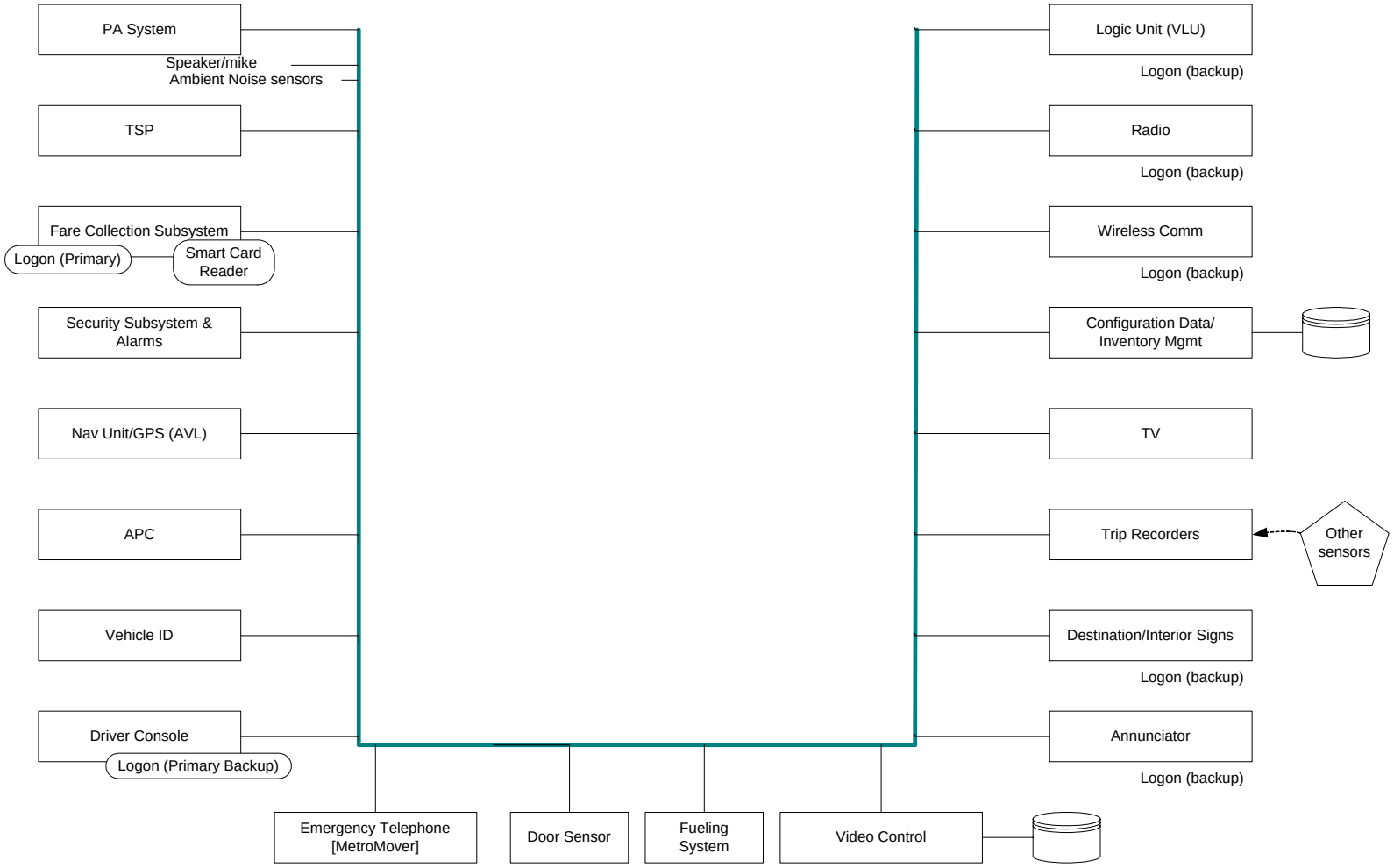
- **Strategic Approach #3: Use of Non-Proprietary Architecture for On-Board Devices and Back-Office Systems**

It is the intent of the IT Division group to provide for non-proprietary architecture and standards for on-board devices and back-office systems. In this architecture, configuration, service, and performance information can be accurately and unambiguously collected, transported, received, and understood by all subsystems, devices, and the fixed-end systems. Further, vehicle subsystems would be modular, expandable, and vendor independent; enhancements would not require the discarding of previous technology investments.

7.3 On-Board Concept of Operations

The On-Board Interconnection Diagram in Figure 7-1 shows a single, non-proprietary communications network that integrates multiple physical devices on board the vehicle.

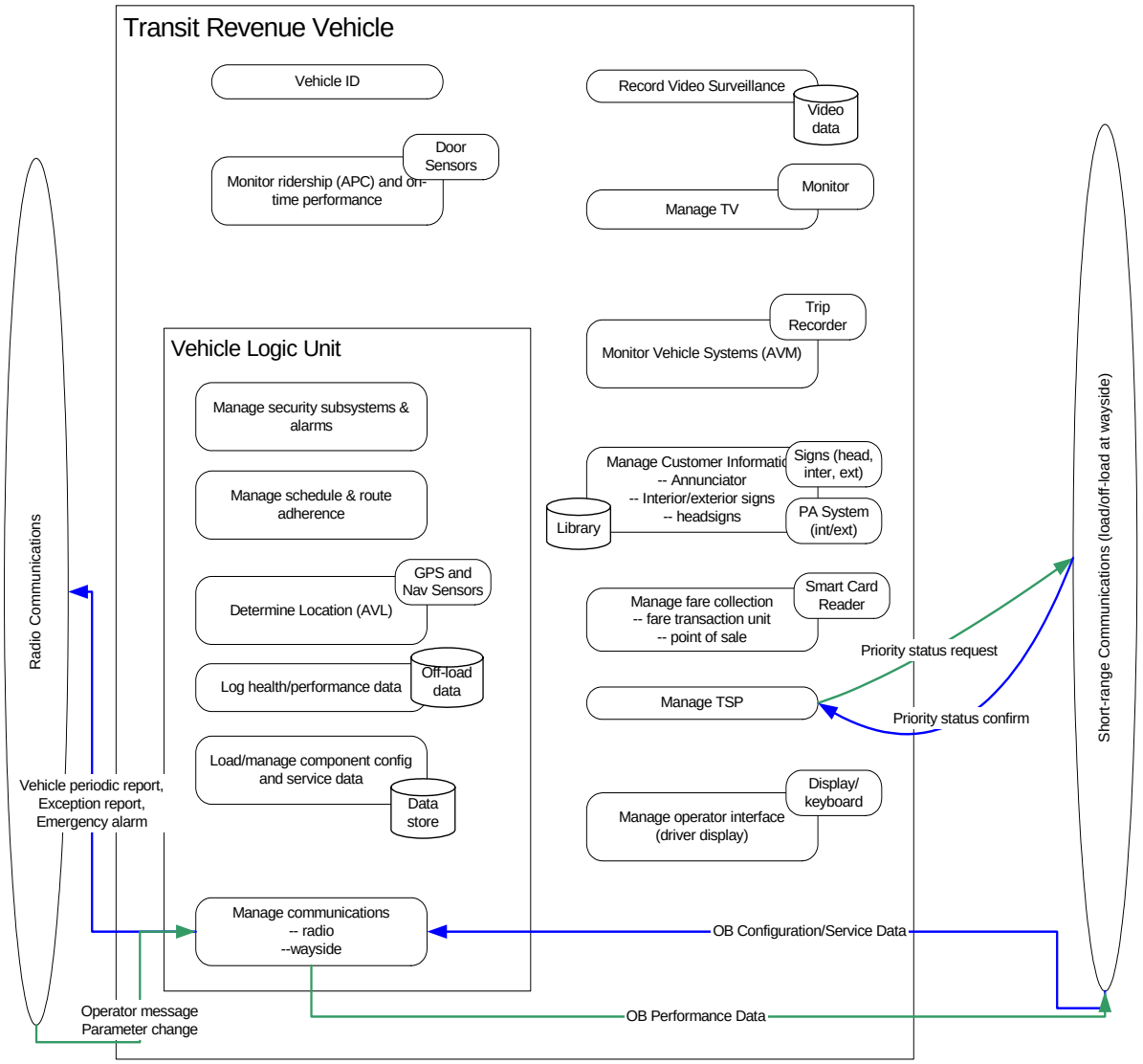
Figure 7-1 On-Board Interconnection Diagram



The interconnection diagram shows the communication connections required by the logical components. Manufacturer models may integrate several components into a single product such as the VLU and radio system, or driver console and Fare Collection Subsystem. This interconnection diagram shows a multicast/unicast network.

In the architecture described by Figure 7-2, various processes are accomplished by subsystem elements. The subsystems may be separate physical devices or they may be integrated into multiple process physical devices. For example, the door sensors and the Automatic Passenger Counting System may be two separate subsystems or they may be combined into a turn-key system. The APC will then report the counts of boardings and alightings per occurrence (door open) to the VLU for storage along with GPS data, time, and confirming farebox receipts. As long as all of the described "functions" communicate with the VAN, the physical implementation is transparent. For example, if the GPS sensor is an integral component of the VLU and communicates with all other physical devices on the vehicle, then location data is available to Annunciators, Fare Collection, and other subsystems on the vehicle. This transparent sharing of information and subsystem control is contained in the SAE family of VAN specifications.

Figure 7-2 On-Board Subsystem Diagram



7.3.1 On-Board Vehicle Discussion

MDT has begun the process of defining and implementing an updated and enhanced On-Board Architecture for its revenue vehicles with the objectives of:

- Reducing capital costs
- Reducing ongoing operating costs
- Reducing the time required to troubleshoot and repair on-board equipment
- Enabling a modular, evolutionary design for deploying on-board systems that supports standards and open (non-proprietary) systems
- Ensuring that the configuration, service, and performance information can be accurately collected, transported, received, and understood by all on-board subsystems, devices, and fixed-end systems
- Improving the management and integration of data between the vehicle and the back office

Currently, on-board systems are dependent on legacy equipment and back-office processes, redundant devices, and proprietary interfaces on the vehicles that make it more difficult for MDT to achieve the objectives listed above. Examples include the following:

- Legacy Vehicle Logic Unit (VLU), Automated Vehicle Location (AVL), and control head units
- Redundant control heads and GPS units for every new subsystem
- Limited storage for annunciators and signage systems
- Limited strategy for migrating new on-board systems using SAE J-1708 Vehicle Area Network (VAN) standards

The overall approach for the on-board physical architecture, including some desirable solutions, is summarized below:

- A single VLU with open architecture
- A single driver console (excepting the farebox control head)
- A single on-board information network (VAN) standard which all devices use to communicate
- Data integration of all information created by on-vehicle devices
- Elimination of redundant wireless communications technologies, sensors, and devices
- Improved maintenance access to information and drive train levels
- An integrated solution with data associated by a synchronized (common) time, location (transit related-location), and event
- Single login point (with backup login points)
- Seamless integration with fixed-end systems and data
- Solution for the radio system coverage and functionality (must be coordinated with the county)

The VLU that currently drives the Annunciator has the capacity to become the desired single VLU on the vehicle, but it lacks the software to interface with the existing radio

network. It does appear to have all the hardware resources necessary to interface with other key on-board subsystems if additional software were added to it.

8 TECHNOLOGY ARCHITECTURE

8.1 Introduction

The Target Technical Architecture defines major kinds of technologies needed to provide a physical environment for the applications that are managing data. The Target Technology Architecture consists of the future physical infrastructure and systems software layers for both fixed-end systems (data center, desktop and end-user access channels, communication networks) and on-board (vehicle–area–networking, radio communications, wireless). The ITS Strategic Plan 2003–2008 Technology Architecture defines strategic platforms and direction, and provides the technical basis for further design and configuration detail.

A sound Target Architecture mitigates against the complexities of development and maintenance, the obsolescence of technologies, and the possibilities that all the parts of a solution may not work together. Architecture is a proven mechanism and approach that can be used to isolate and mitigate the risks of delivering applications now and into the future. An architecture plan provides a framework for how intelligent transportation systems and information technology systems will work together to support MDT's current and future needs. It is a critical success factor in client/server and net-centric systems development.

In addition to providing a framework for making different systems work together, architecture provides differentiation to assist in "build-versus-buy" decisions. At one extreme, the IT Division can choose to "build an architecture" to make it very close to ideal; this necessitates a great deal of development be done by the IT Division staff. At the other extreme, the IT Division could choose to not follow technology architecture and purchase only "best of breed" applications with no assurance of integration and with expensive proliferation of incompatible technologies with significant maintenance costs. The MDT IT Division's direction has had a tendency to "buy" rather than "build" and several core application components are now in place. Within the transit industry, vendors have been slow to adopt the more sophisticated open-platform methods now maturing and available in the marketplace. In most cases, transit vendor architectures remain proprietary or "closed" in nature due to extreme competitive pressures, and often do not offer any real choice of platform.

In recognition of these challenges, the MDT IT Division will move forward over the 2003–2008 planning horizon to direct project initiatives within the framework of a modern Technology Architecture, wherein open platform and sophisticated client/server models better enable transit to serve its customer. The IT Division plans to continue its policy of building technology architecture components only when essential and not compromise in providing needed application functionality. By purchasing compatible systems rather than having to learn new hardware and software, the MDT IT Division can more easily apply its technical resources in key areas of systems engineering, data design, and data management, as well as rollout of new applications. As transit services demand for transparent access to information increases, ITS developers can focus on sound integration of data and applications rather than the maintenance of legacy or incompatible systems.

8.2 Strategic Approaches

Strategic Approach #1: Client/Server Model with Central Data Management
The target Technology Architecture will utilize an N-Tier Client/Server architecture with central data management. This architecture is highly scalable and offers the best performance of any client/server application architecture. Any combination of user interfaces (character, graphical, web browser, telephones, and others) can be supported. Through this approach critical enterprise data will be managed and stored distinct from the many business processes that access and use it.

Strategic Approach #2: Well-Planned Disciplined Migration Planning
The transition process needed to deliver the target architecture systems solutions will likely last several years. Over the five-year planning horizon MDT will move through evolutionary stages of distributed architecture approaches. Modern system tools and technologies will be applied to address data integration and operational management challenges.

Strategic Approach #3: Open Systems Concepts and Industry Standards
MDT IT will apply open systems concepts and leverage industry standards to insure portability, scalability, interoperability, and compatibility of information technology systems.

Strategic Approach #4: Apply IT Guiding Principles
The IT Guiding Principles are a basis for governance and implementation of the Technology Architecture. The IT Guiding Principles support MDT Vision, Mission and Goals, and affect development, maintenance, and selection of technologies.

8.3 Technology Architecture Factors

Table 8-1 highlights some of the factors in MDT's environment that guide how technology changes should be implemented in Transit.

Table 8-1 Factors Impacting MDT Technology Architecture

#	Consideration	Description
1	Regional integration	County goals for multimodal regional transit
2	Geographical distribution	Business functions are spread over several different sites; expansion to new sites is planned.
3	Centralization of services vs. local autonomy	Ability of local sites to be able to operate independently from the central organization
4	Performance	Business improvement goals as measured by service and ridership, and by technical improvement goals as measured by response time and/or batch throughput
5	Scalability	Plans for services expansion (PTP) and use of ITS has caused volume of data to expand, and volume of processing to increase.

6	Mobility	Business functions require workers to have access to corporate information even when they are out of the office or unable to connect to the corporate network.
7	Multiple distribution channels	New Transit services will provide customer information through a variety of communication devices.
8	Currency	Business requirements for freshness of some data will indicate that real-time or close-to-real time data currency is necessary.

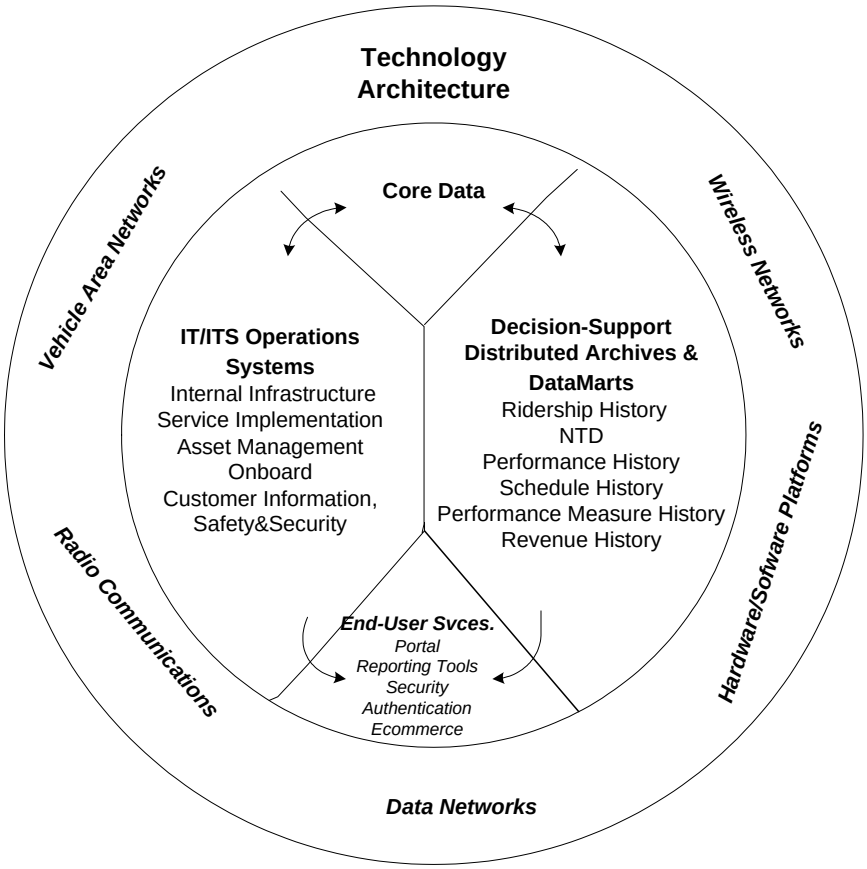
8.4 Technical Architecture Model

In the Technical Architecture Model in Figure 8-1, a physical systems environment infrastructure surrounds and supports data and application systems and provides secure end-user services on the desktop or other browser-based access methods.

The Data and Application Architectures are physically separately maintained. The Data Architecture is maintained through the Core Data environment to ensure that vital data needs such as routes and patterns are shared with integrity between different systems through the use of sophisticated data management methods leveraging standardized data flows and available middleware techniques (arrows). The Application Architecture further physically separates IT/ITS Operations "data capture" systems from Decision-Support "data access" systems for better manageability and performance.

End-User Services through standard desktop tools and strictly managed configurations allow cost-effective, secure access of information via a "portal" into the appropriate systems application environment.

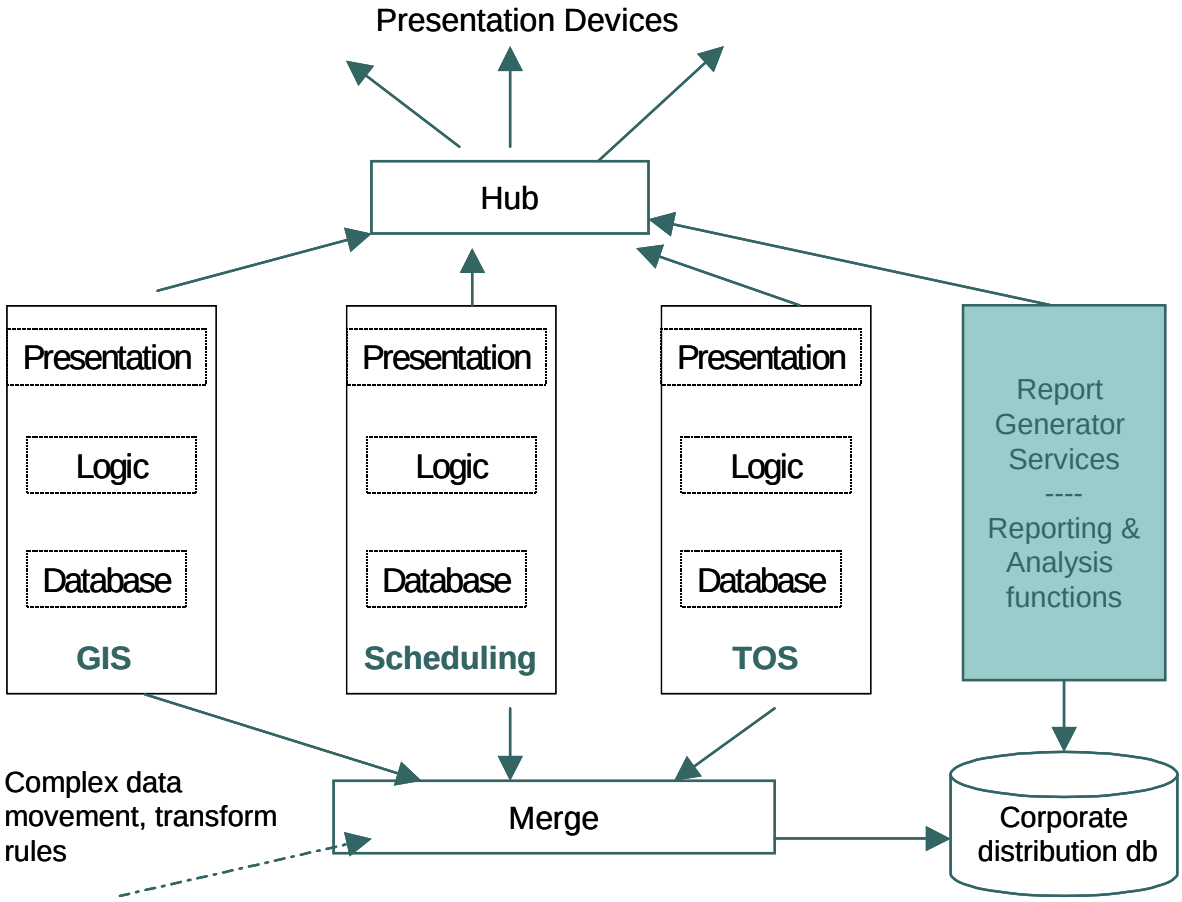
Figure 8-1 Technology Architecture Model



8.4.1 N-Tier with Central Data Management

It is recommended that the MDT Target Technical Architecture move in a well-planned manner toward an N-Tier Client/Server Architecture with Central Data Management. This model is illustrated in Figure 8-2.

Figure 8-2 Target Application Architecture Model: MDT N-Tier with Centralized Data Management



Through this model, the MDT Target Technology Architecture will provide for critical enterprise data to be managed and stored distinct from the many business processes that access and use it. Modern application development tools and technologies will be applied to address data integration and management challenges. Systems approaches will employ:

- Units of code previously duplicated in many applications can be packaged into components or services and reused by different applications
- Middleware integration approaches allow applications to communicate with each other, access data residing on different platforms, and access the shared services
- New user interface devices, such as web browsers, pagers, and voice response units (VRUs)

The N-Tier Client/Server Model with Centralized Data Management is a distributed architecture environment, where a key characteristic is data that is physically separate from the application processing or distributed among two or more servers, which then must be coordinated.

Applying the technical principles, models, and standards expanded upon in the following sections is key to reducing the complexity and cost of the target distributed environment. The Data and Application Architectures prescribe the identification and management of "core data." This recommended model requires the disciplined application of data warehousing concepts within a centralized data management distribution architecture framework.

8.4.2 Middleware Architecture

MDT IT is now preparing the implementation of back-end business systems, which require close coordination with county administrative functions, following county technical standards and direction (DCOM/.NET). Transit-specific operations systems are often dictated by vendor-provided solutions, and require support of dual platforms utilizing either DCOM/NET or J2EE/RMI. The IT Division has adopted both DCOM/.NET and J2EE/RMI as viable platform strategies. The development language selection influences object model selection so a blended middleware technology standard will be supported and specific product standards will be prescribed through a committee recommendation.

8.4.3 Network Architecture

The IT Division promotes a single reliable, scalable, resilient set of agency network infrastructures that economically supports transit business functions in an efficient and effective manner. The Network Architecture provides the framework and foundation to enable MTD business processes, new Transit service opportunities, and new methods for delivering these services.

Specific information is provided in *Appendix B: Technical Architecture Details*. Further information on Wireless and On-Board Communications is found in Chapter 9.

8.4.4 Production Architecture

The IT Division Production Architecture describes a reliable, scalable, interoperable set of technical and logical technology platform devices to implement and support agency business functions in an efficient and effective manner.

8.4.5 Development Architecture

The Development Architecture environment is a mirror of the platforms used in the Production Architecture. Within the development environment, MDT is considering the adoption of tools that will further aid staff productivity.

8.4.6 Operations Architecture

The Operations Architecture encompasses the coordination of system and network resources throughout the enterprise. The Operations Architecture provides the guidelines for managing the reliable enterprise-wide operation of mission critical applications.

8.4.7 Technology Architecture Migration Direction

An overview of technology strategies to guide migration from the current technology environment to the target is listed in Table 8-2 below. Expanded information on specific technology initiatives, both fixed-end and onboard infrastructure, is found in Chapter 12.

Table 8-2 Overview of Technology Architecture Migration Direction

2003 As-Is Observation	2008 Target Direction
Application Models:	
• Mix of monolithic, 2-tier, and enhanced 2-tier models	• Increasingly design and procure applications which adhere to an N-tier application model
• Business rules tightly integrated with the graphical user interface	• Business rules implemented discretely, perhaps separately on an App server
• Reduced flexibility where business rule can be deployed	• Application component deployment is flexible and scalable to accommodate greater transaction volumes
• Application software deployment support intensive to maintain and upgrade	• Increasingly develop and deploy client/GUI's which are browser based or require zero desktop footprints
• Applications communicate with other applications due to the proprietary nature of the underlying technology	• Increasingly design and deploy applications where underlying technology is based on open standards
• Low reuse of redundant code and business rules between applications	• Library application components, business rules, and methods for future sharing and redeployment
• Difficult to integrate applications to share services and data	• Design application with integration capabilities, leverage middleware services and conform to application integration standards
Related Activity: As part of the Project Management Methodology, establish an application design review. The objective is to assess and review adherence to the Enterprise Architecture, propose design alternatives to better comply with the Enterprise Architecture, and approve waivers should business justification be compelling and appropriate.	
Middleware:	
• Dual support of DCOM/.NET and J2EE/RMI as viable platform strategies with dual support significantly driving up the complexity of middleware integration	• A single open-platform strategy significantly reducing integration, deployment and maintenance
• Limited integration standards definitions and tools	• Prescribed integration methods, tools, and technical and data standards which provide developers integration guidance to ensure consistency, flexibility, and manageability, thus enabling enterprise agility

Related Activity: Establish an Application Integration and Middleware function or committee to further define integration requirements, establish standards and reference models, and determine required tools and processes to operationalize the application integration architecture	
Network Architecture:	
• Network services designed for supporting specific application and departmental needs	• A single reliable, scalable, resilient set of agency network infrastructures that economically supports Transit business functions in an efficient and effective manner
• Separate dedicated networks for different services, flat designs with reactively managed bridges, hubs, proprietary protocols	• Converged networks with prioritization for all services; switched, multisegment design; IP; RIP; BGP; OSPF
• Network management methodologies that react to changing capacity and performance needs, management tool investment not fully utilized to monitor network health status, service availability, and problem alerting	• Network devices (routers, switches, firewalls, access servers, etc.) fully leverage network management platforms that use Simple Network Management Protocol (SNMP) and Remote Network Monitoring (RMON) to monitor performance, availability, and capacity usage and proactively alert data center operations of network health status
Platform Architecture:	
• Overall technical architecture is highly diverse, extremely complex, support intensive, and difficult to sustain given current support staff levels and value delivery required by the business.	• Defined network and platform infrastructure standards and governance, driven by Transit needs for manageability, security, and reduced total cost of ownership (TCO) aligned with Transit business needs
• Proprietary and legacy platforms	• Platform devices relative to their versatility, capability to seamlessly interoperate with other platform devices, operating systems, embedded security, adherence to open or pervasive industry standards, provision for open system standard interfaces, and utilization of open standard drivers
• Multiple platforms variations and version levels	• Production configurations and associated operating system versions managed and minimized to ensure supportability and reduce maintenance costs

Operation Architecture:	
• Limited capability to evaluate "at a glance" the overall health of network and platform infrastructure	• Deploy and leverage integrated management suite
• Reactive systems management, limited problem diagnostic tools to determine root cause analysis	• System components proactively alert in advance of failure, including predictive capability. System-generated alarms and alerts automatically routed to the appropriate systems management resource
• Software deployment and maintenance manually intensive	• Deployment of remote system management services such as asset inventory, software deployment, and remote control allowing the automation of low-value support services and enabling highly responsive virtual support services
• Limited measurement of end-user experience and service availability	• Leveraged enterprise management suites that monitor end to end services and established monitoring levels and benchmarks which can be used to measure IT business impact and value
Related Activity: Establish a Network and Data Center Operation Service(s) Model that will deploy, develop, and define tools, processes, and procedures of the systems management framework for project teams.	

8.4.8 Technology Architecture (Fixed-End) Strategic Initiative Discussion

Seven strategic initiative areas were identified to improve the Technology Architecture and physical infrastructure support at MDT. These initiatives include an On-Board Communications / Integration with Back-End Systems initiative (SI-27-T) that is closely related to the On-Board Bus Infrastructure and Replacement initiative (SI-01-DA).

	Technology Architecture Strategic Initiatives
SI-21-T	Data Center Systems Environment Modernization
SI-22-T	Desktop Support and Configuration Standardization
SI-23-T	IT Service Model and Operational Procedures
SI-24-T	Distributed Network Design
SI-25-T	Network and System Management
SI-26-T	Quality Assurance / Application Development Environment
SI-27-T	On-Board Communications / Integration with Back-End Systems

The content of the technology initiatives is discussed in Chapter 11.

9 WIRELESS AND ON-BOARD COMMUNICATIONS

The on-board physical/technical architecture may be viewed as a Reference Architecture for Metrobus, Metrorail, and Metromover. Details related to the architecture implementation will vary depending on the mode and fleet type.

These designs have been in use for some time in Transit vehicles in the fly-by-wire drive trains that move them. The VAN is a separate implementation that integrates all Information-level functions that are unique to Transit Operations. The VAN also supports the capture and real-time forwarding of drive train performance data.

9.1 Vehicle Area Network

9.1.1 Description

"A data communications network that is installed on a public transit vehicle. The network supports data exchanges between various on-board subsystems. Similar to a Local Area Network (LAN) in a company or an office, a vehicle area network supports data communications primarily in a transit vehicle." [NTCIP 1406, p., 2-1]

9.1.2 Requirements

A communications network that controls and integrates the "Information" and the Input/Output ("I/O") devices and subsystems installed on-board the transit vehicle operating in revenue service. This "Information" must be clearly defined to fixed end systems.

9.1.3 Available Standards

A Society of Automotive Engineers (SAE) family of standards defines the Vehicle Area Network (VAN), including:

- J-1708 — Protocol, error detection, and correction
- J-1587 — Data and Metadata
- J-1455 — Environmental conditions in which vehicle devices must survive
- J-2496 — Cabling of a vehicle to permit plug-and-play insertion/removal of devices and fault diagnostics
- J-1939 — High-speed communications (currently in final ballot at the SAE)

These designs have been in use for some time in Transit vehicles in the fly-by-wire drive trains that move them. The VAN is a separate implementation that integrates all Information-level functions that are unique to Transit Operations, as well as providing for the capture and real-time forwarding of drive train performance data.

9.2 Wireless Communications

9.2.1 Description

Wireless communications is a means of transferring data to, and from, the vehicle while stationary or moving at low speed. Traditional radio systems (e.g., 800/900 MHz Trunked Voice/Data radio networks) are used for the transfer of real-time vehicle data (location, alarms, status, etc.) and management directions (driver instructions). This type of radio technology is too slow, and shared by too many vehicles, for the massive amounts of data required by Annunciator, AVL, and Schedule Adherence subsystems on the vehicle. Likewise, a large amount of performance data collected on the vehicle needs to be transferred as batch data at the end of the day.

Wireless LAN technology and/or Digital Short-Range Communications (DSRC) standards are becoming the technology of choice for these large data transfers at specific points (i.e., transit garages, transit centers, park & ride lots, etc.).

9.2.2 Requirements

The transfer rate of wireless networks is normally far too high to be handled by serial communications ports (i.e., RS-232). The vehicle's Logic Unit (controller) would normally interface to these systems with Databus speed via Direct Memory Access (DMA), either directly or through a Network Interface Card (NIC). Older Logic Units may or may not be sufficient to accommodate the new wireless technology.

9.2.3 Available Standards

Currently, there are several standards that are worthy of consideration:

- IEEE 802.11a
- IEEE 802.11b
- IEEE 802.11g
- DSRC

It should be noted that these are transport-level standards. The data and metadata transported by these transport standards should consider the ITS TCIP standards for data content and message sets. Each of these standards requires some form of security software as well.

9.2.4 Wireless Communications Issues

A single wireless communication technology is desirable. This technology would be used for multiple on-board subsystems including video surveillance, loading configuration data, and off-loading operational performance and fare box/APC stop-level ridership data. Security of the information remains uncertain. Since the wireless Ethernet technology (IEEE 802.11x) is a standard, it is susceptible to attack by hackers. There are, however, software or technology fixes to ensure authentication and prevent access to on-board information.

9.3 Radio Communications

9.3.1 Description

There has always been a need for real-time Dispatcher-to-Driver-to-Dispatcher communications in Transit systems. Originally, this communications was limited to voice only. Later, digital data enhanced radio networks enabled the exchange of AVL, alarm, and status information as well as streamlining instructions to drivers through alphanumeric control heads on vehicles. To date, there is no cost-effective alternative to these networks when large numbers of vehicles are involved.

9.3.2 Requirements

Real-time radio networks must provide for:

- At least 95% coverage of the service area 95% of the time
- Sufficient number of dispatcher positions to handle the driver-waiting queues
- A design capable of logically addressing the number of vehicles in the fleet
- Silent alarms from vehicles, even if all other on-vehicle subsystems fail
- Transport of real-time data to, and from, the vehicle and its on-board devices

9.3.3 Available Standards

There are no published standards associated with voice / data networks. Rather, each radio manufacturer has protected its years of research and development in proprietary designs with patents and copyrights (i.e., Motorola, Johnson, Ericsson, etc.). However, these networks can be viewed as a data transportation network capable of transparently passing data defined by published standards (i.e., SAE-J1587, TCIP) if the system integrator is charged with this requirement during procurement.

10 STRATEGIES FOR MOVING AHEAD: AN OVERVIEW

The titles of the strategic initiatives proposed for moving MDT and IT ahead are listed below with their identification numbers.

IT Strategic Initiatives

Number*	Data and Applications Strategic Initiatives
SI-01-DA	On-Board Bus Infrastructure and Replacement
SI-02-DA	Automated Passenger Counting
SI-03-DA	Customer Information Network
SI-04-DA	Real-Time Information
SI-05-DA	Bus Traffic Control Management
SI-06-DA	E-commerce
SI-07-DA	Fare Collection
SI-08-DA	Paratransit
SI-09-DA	Safety and Security
SI-10-DA	Traffic Signal Prioritization (TSP)
SI-11-DA	Scheduling Enhancements and Planning Tools
SI-12-DA	Workforce Management (TOS Replacement)
SI-13-DA	EAMS — Materials Asset Management / Procurement
SI-14-DA	Finance (GL / AP / AR)
SI-15-DA	HR (Training, Payroll, Employee Information)
SI-16-DA	Electronic Document Storage
SI-17-DA	Capital Project Control
SI-18-DA	Core Data Management
SI-19-DA	Decision Support Tool / Datamart
	Technology Architecture Strategic Initiatives
SI-21-T	Data Center Systems Environment Modernization
SI-22-T	Desktop Support and Configuration Standardization
SI-23-T	IT Service Model and Operational Procedures
SI-24-T	Distributed Network Design
SI-25-T	Network and System Management
SI-26-T	Quality Assurance / Application Development Environment
SI-27-T	On-Board Communications / Integration with Back-End Systems
	Organizational Strategic Initiatives
SI-31-O	Administrative Planning
SI-32-O	Policy Development and Standards
SI-33-O	Service Management
SI-34-O	Project Management
SI-35-O	Business Process Reengineering
SI-36-O	Skills Planning and Training Program

SI-37-O	Target Organization / Transition Management
SI-38-O	IT/ITS Strategic Planning

* SI = Strategic Initiative
DA = Data and Application
T = Technology
O = Organizational

The 19 Data and Application Strategic Initiatives are presented in Chapter 11. Seven Technology Architecture Strategic Initiatives are presented in Chapter 12, including an On-Board Communications/Integration with Back-End Systems Initiative (SI-27-T) that is closely related to the On-Board Bus Infrastructure and Replacement Initiative (SI-01-DA). Finally, Chapter 13 presents eight strategic initiative areas designed to improve the organization and operation of the IT Division.

The Data and Application, Technology, and Organizational Strategic Initiatives must be considered together as a whole, even though they are presented in separate chapters. Initiatives in one area may have impacts in others. The initiatives were presented in different chapters to facilitate access to them by different audiences as the IT/ITS Strategic Plan is used.

11 DATA AND APPLICATION STRATEGIC INITIATIVES

11.1 Overview

Nineteen key data and application initiatives were developed to guide MDT's investment in data and applications to meet the needs of its stakeholders, including customers, MDT staff, county management, elected officials, and others. There are a number of different reasons for identifying these particular initiatives as being priorities over the 2003 to 2008 time period, such as the following:

- Some initiatives correspond to large, complex projects that involve multiple stakeholder groups and need the oversight of senior transit managers to ensure necessary coordination and decision making with an enterprise-wide perspective.
- Other initiatives are necessary, like a building foundation, for the success of specific business applications and effective information access within MDT.
- A few initiatives are included to remind MDT and the IT Division to be vigilant for changes in other areas that can have significant impacts on transit, such as changes to the county's financial or human resource systems.
- Contributing to the inclusion of some of the initiatives, such as Finance or Human Resources, is the fact that they support critical success factors for MDT.

11.2 Data and Application Initiatives

11.2.1 Initiative: SI-01-DA On-Board Bus Infrastructure and Replacement

Description: The On-Board Bus Infrastructure and Replacement Initiative will replace the existing automatic vehicle location and monitoring system and integrate other on-board systems, such as CCTV / video surveillance, annunciators / signage, destination signs, and automated fare collection, into an integrated environment. This initiative should be developed in a number of phases:

Phase 1: Develop approach and processes for backbone (e.g., vehicle area network), key functions (e.g., location determination, logon, operator display), and replacement versus upgrade (technology trade-off study). Prioritize functions, gather user requirements, and develop migration strategy.
Phase 2: Develop user requirements and system specifications including links to CAD, AFC, APC, upload / download data files, etc.

Primary Process(es): Service Management (primary); Safety and Security; Service Implementation

Item	Description
Transit Goals Supported:	Goal 1: Maximize Use and Efficiency Goal 4: Innovative Solutions Goal 7: Improve Support Services
IT Division Goals Supported:	Goal 1: Enhance Customer Information Goal 2: Improve Business Tools and Information Goal 3: Upgrade IT Environment Goal 5: On-Board Vehicle Improvements Goal 6: Enhance Safety and Security

Issues and Considerations:	• Primary Metrobus; may include some Metrorail and Metromover projects (e.g., video surveillance, fare collection)
	  • Plan System Replacement Approach; this includes migration approach (how much is turnkey; prioritize functions).
	  • Include single operator display and logon process.
	  • Integration with CAD [SI-05-DA], APC [SI-02-DA], GPS, electronic fare collection [SI-07-DA], maintenance diagnostics, etc.
	• Dependencies on VAN, wireless short range (wayside), and radio communications initiatives [SI-27-T]

	• Explore service and configuration loading and performance data off-loading requirements. Dependencies on Core Data Management [SI-18-DA]. • (See discussions in Section 7 and 9.)
MDT Architecture Subsystem	• Technology o Radio o Wayside (short range) o VAN • Data / Application o Vehicle Logic Unit (VLU) o Automated Passenger Counting (APC) o Manage on-board customer information o Automate Fare Collection System o Operator Console o Video Surveillance o Transit Signal Priority (TSP) o Vehicle ID o TV o
National ITS Architecture User Service Bundles (optional):	2.1 Public Transportation Management 2.2 En-Route Transit Information
Related Projects Initiatives:	See current IT business plan

11.2.2 Initiative: SI-02-DA Automated Passenger Counting (APC)

Description: The Automated Passenger Counting Initiative is targeted at collecting information to support planning functions. The initiative involves installing sensors on board revenue vehicles (Metrobus, Metrorail and Metromover) to count the number of passengers who board and alight the vehicle at stops along trips/routes during different times of day and days of week. The APC initiative may also collect schedule adherence (e.g., running times, dwell times, and other performance measures) of the vehicle as it traverses the assigned vehicle path.

Phase 1: Gather requirements and develop prototype specification and RFP.
Phase 2: Deploy prototype and assess results, and identify data integration (loading) and data collection (off-loading) issues. Develop strategies for processing and using datasets.
Phase 3: Perform systems engineering analysis (including technology trade-offs based on dependent initiatives (e.g., SI-01-DA, SI-11-DA, SI-18-DA).

Primary Process(es): Service Implementation (primary); Service Management

Item	Description
Transit Goals Supported:	Goal 1: Maximize Use and Efficiency Goal 4: Innovative Solutions Goal 5: Expand Services Goal 6: Intermodal Linkages *(if APCs are installed on Metrorail and Metromover vehicles)* Goal 7: Improve Support Services
IT Division Goals Supported:	Goal 2: Improve Business Tools and Information Goal 5: On-Board Vehicle Improvements
Issues and Considerations:	• Plan pilot deployment prior to procuring system to determine data quality and integration needs. • Dependencies on integration of vehicle assignments (trips), patterns and bus stop data; requires rigorous and timely procedures for managing the bus stop inventory. • If APCs are not system-wide, then assigning vehicles to routes will impact Metrobus maintenance, dispatch, and garage parking. Procedures for coordinating assignments among these stakeholders will be necessary. • Develop strategies for "cleaning" and validating APC data prior to installation; this may require reconciliation with fare collection data [SI-07-DA] and AVL/Schedule

	Adherence data (from On-Board Infrastructure and Replacement Initiative, SI-01-DA). • Interface to off-load the data should be interoperable with the Scheduling Enhancements and Planning Tools [SI-11-DA] Initiative, the acquisition of software analysis, and visualization and reporting tools to review APC datasets. If additional datasets such as demographics, land use, etc. are used, then consistent geo-coding to the MDT base map may become an obstacle. • If the APC implementation is fully integrated into the On-Board Infrastructure and Replacement approach, deployment issues may be significantly impacted. Phase 3 of this initiative should be closely coordinated with [SI-01-DA].
MDT Architecture Subsystem	• Planning • Fixed Route Scheduling • On-Board: Automated Passenger Counting (APC)
National ITS Architecture User Service Bundles (optional):	2.1 Public Transportation Management
Related Projects and Initiatives:	• See current IT business plan

11.2.3 Initiative: SI-03-DA Customer Information Network (CIN)

Description: A regional initiative for which MDT is the lead agency, the CIN will include the following functions:

- Provide regional trip itinerary
- Provide fare information
- Provide transit info and publications
- Process commendations and complaints
- Provide special events, evacuation, and detour information
- Process subscription services
- Provide real-time service status
- Provide en-route information
- Provide exceptions / service disruptions

A vendor solution has already been selected, and so the major effort will be to

1. Provide MDT service information
2. Develop a strategy to coordinate procedures in the region, including integrating and updating transit information data such as (single) regional base map, bus stop numbering, and transfer locations; fare data and coordinate messages among participating agencies related to exceptions and disruptions

Internal Phases
Phase 1: Plan operational strategies including management and update of service information needed to meet functional requirements; this may require adoption and transformation of data to conform to a regional base map. Identify distribution channels (e.g., kiosk, web, IVR, call center) and special requirements for each; phase deployment of distribution channels.
Phase 2: Development and testing: develop and test applications and data sets to meet requirements (coordinate with Real-Time Information Initiative [SI-04-DA]). This phase is based on the phased deployment strategy developed in Phase 1.
Phase 3: Implement and operate (includes on-going data and system maintenance).

Coordination Phases
Phase 1: Develop strategy to coordinate management processes for CIN; develop data coordination and update requirements for service information.
Phase 2: Develop coordinating group to oversee and implement operating and data integration strategies.

Primary Process(es): Customer Information	
Item	**Description**
Transit Goals Supported:	Goal 1: Maximize Use and Efficiency Goal 3: Regional Systems Goal 4: Innovative Solutions Goal 5: Expand Services Goal 6: Intermodal Linkages
IT Division Goals Supported:	Goal 1: Enhance Customer Information Goal 2: Improve Business Tools and Information Goal 6: Enhance Safety and Security
Issues and Considerations:	• Regional base map • Data dependencies include fare structure, service (bus stop, route by pattern, timetables, service types). • Regional coordination and maintenance of datasets particularly inter-modal and interagency transfer points. • Multi-agency operating procedures will impact data integration and distribution, privacy and security policies, and licensing issues.
MDT Architecture Subsystem	• Customer Information
National ITS Architecture User Service Bundles (optional):	1.1 Pre-Trip Travel Information 2.1 Public Transportation Management 2.2 En-Route Transit Information
Related Projects and Initiatives:	• See current IT business plan

11.2.4 Initiative: SI-04-DA Real-Time Information

Description: This initiative offers real-time status information for Metrobus, Metrorail, and Metromover using different methods of user access. For example: active bus stop or station signs, web maps, pagers / PDAs using WIFI, voice-XML and other communications technologies.

Primary Process(es): Customer Information

Item	Description
Transit Goals Supported:	Goal 1: Maximize Use and Efficiency Goal 4: Innovative Solutions Goal 5: Expand Services Goal 6: Intermodal Linkages Goal 7: Improve Support Services
IT Division Goals Supported:	Goal 1: Enhance Customer Information Goal 2: Improve Business Tools and Information Goal 5: On-Board Vehicle Improvements Goal 6: Enhance Safety and Security
Issues and Considerations:	• Develop internal policies on presenting real-time service status and disruption information. • (See FTA "Guidance for Developing and Deploying Real-Time Information Systems for Transit" http://www.fta.dot.gov/research/fleet/its/rtist/index.htm.) • Develop different strategies for Metrobus, Metrorail, and Metromover
MDT Architecture Subsystem	• On-Board Subsystems o VLU (AVL, Schedule Adherence) • Customer Information o Process subscription services (includes subscription and translation to different distribution channels) o Provide real-time service status o Provide en-route information o Provide exceptions / service disruptions

National ITS Architecture User Service Bundles (optional):	1.1 Pre-Trip Travel Information 2.1 Public Transportation Management 2.2 En-Route Transit Information
Related Projects and Initiatives:	• See current IT business plan

11.2.5 Initiative: SI-05-DA Bus Traffic Control Management

Description: This initiative is a replacement project for the existing Computer Aided Dispatch (CAD) system. This replacement will combine operations management functions, including operator and service information lookup, incident management (and reporting), fleet management, supervisor / maintenance dispatch, and management. The interfaces will eliminate the need to interface with TOS and rely on the Census format for updating the map database. Further, the effort will extend the CAD operations into the supervisor vehicle through the use of a laptop CAD.

Primary Process(es): Service Management

Item	Description
Transit Goals Supported:	Goal 1: Maximize Use and Efficiency Goal 4: Innovative Solutions Goal 5: Expand Services Goal 6: Intermodal Linkages Goal 7: Improve Support Services
IT Division Goals Supported:	Goal 2: Improve Business Tools and Information Goal 3: Upgrade IT Environment Goal 6: Enhance Safety and Security
Issues and Considerations:	• Impacts from and dependencies on the radio system [SI-27-T], associated on-board vehicle systems [SI-01-DA]; TOS Replacement [SI-12-DA] • Linkages to rail and other transit management centers may be established to coordinate transfers. • Linkages to traffic management centers, including traffic condition messages and CCTV feeds to BTC, may be helpful.
MDT Architecture Subsystem	• Metrobus Operations • Incident Management
National ITS Architecture User Service Bundles (optional):	2.1 Public Transportation Management
Related Projects and Initiatives:	• See current IT business plan

11.2.6 Initiative: SI-06-DA E-commerce

Description: Develop an e-commerce capability to sell fare media via the web (and possibly kiosks)

Primary Process(es): Customer Information (primary); Internal Infrastructure (Finance)

Item	Description
Transit Goals Supported:	Goal 1: Maximize Use and Efficiency Goal 4: Innovative Solutions Goal 5: Expand Services
IT Division Goals Supported:	Goal 1: Enhance Customer Information Goal 2: Improve Business Tools and Information
Issues and Considerations:	• Coordinate with Finance on financial reporting and fare media distribution issues.
MDT Architecture Subsystem	• Customer Information o Provide fare information / sell fare media
National ITS Architecture User Service Bundles (optional):	1.1 Pre-Trip Travel Information
Related Projects and Initiatives:	• See current IT business plan

11.2.7 Initiative: SI-07-DA Fare Collection

Description: The Fare Collection Initiative includes on-board, gate, back office, Ticket Vending Machines (TVM), and Ticket Dispensing Machines. The fare collection system includes fare transaction processing, point of sales, gated entry or on-board equipment, and fare processing functions. Back-office functions include revenue and ridership / usage reconciliation. The transaction unit processes financial transactions (e.g., collects fares, adds / deducts value, reads fare instruments) and the fare processing unit calculates the fares (based on fare tables and policies). The fare collection system will use cash, magnetic tickets, and smart cards. The smart cards will be managed by a regional consortium. Although all financial transaction information is processed through the revenue reconciliation process (see Internal Infrastructure primary process), the smart card and magnetic ticket transaction data is provided to the Regional Smart Card Consortium.

Primary Process(es): Internal Infrastructure (primary); Customer Information; Service Management

Item	Description
Transit Goals Supported:	Goal 1: Maximize Use and Efficiency Goal 3: Regional Systems Goal 4: Innovative Solutions Goal 5: Expand Services Goal 6: Intermodal Linkages Goal 7: Improve Support Services
IT Division Goals Supported:	Goal 2: Improve Business Tools and Information Goal 5: On-Board Vehicle Improvements Goal 6: Enhance Safety and Security
Issues and Considerations:	• Institutional issues between regional stakeholders are key to ensure smooth deployment. • Coordinate with HR on employee ID and Facilities for access security. • Coordinate with Operations to use cards for operator assignments and login procedures. • Coordinate on-board farebox equipment with AVL; impacts logon, operator control head, interface with VLU for real-time alarms, etc. [MDT-AD-001]. • Engage vendor on fare table configuration requirements. • Engage vendor on revenue reconciliation procedures and data descriptions / interfaces of the downloads; the downloaded data will impact Planning as well as Finance.

MDT Architecture Subsystem	• Revenue Reconciliation • Smart Card • Fare Vending Machine / Fare Dispensing Machine • Fare Transaction Unit (on-board and gate)
National ITS Architecture User Service Bundles (optional):	2.1 Public Transportation Management (smart card; fare payment)
Related Projects and Initiatives:	• See current IT business plan

11.2.8 Initiative: SI-08-DA Paratransit

Description: The Paratransit Initiative will implement the various functions necessary to support the following functions: provide certification; manage Medicaid service (reservations and dispatch); manage ADA service; manage complaints and commendations; manage county billing; manage state billing for Medicaid and special transportation services (STS) service providers. The vendor solution has already been selected. Phasing for deployment are listed below:

Phase 1: Medicaid Implementation

- Implement Trapeze PASS, COM, Cert with interfaces to verify eligibility and to submit billing to Consultec. This implementation provides for Medicaid reservations, scheduling/routing, dispatching, and complaint resolution. It also provides for certification and eligibility checking for Medicaid, STS and MetroPass clients.

Phase 2: STS Implementation

- Implement PASS and COM at STS Contractor and service provider sites for reservations, scheduling/routing, dispatching, complaints, and commendations.

Phase 3: Implement Trapeze PASS-IVR

- Implement PASS-IVR for client trip confirmation and cancellation over the phone

Phase 4: Implement Trapeze PASS-WEB

- Implement PASS-WEB for client trip confirmation and cancellation over the Internet

Phase 5: Implement On-Board Equipment (Mobile Data Terminals)

- This service will be implemented following confirmation of new STS contract. Implement Mobile Data Terminals in STS service provider vehicles to monitor vehicle location and on-time performance. Driver manifests and changes to schedules may be automatically sent to drivers via the MDT units, thus reducing voice communications.

Primary Process(es): Service Implementation (primary); Service Management

Item	Description
Transit Goals Supported:	Goal 1: Maximize Use and Efficiency Goal 4: Innovative Solutions Goal 5: Expand Services

IT Division Goals Supported:	Goal 1: Enhance Customer Information Goal 2: Improve Business Tools and Information Goal 5: On-Board Vehicle Improvements
Issues and Considerations:	• Coordinate this deployment with Customer Information (particularly distribution channels such as web and IVR).
MDT Architecture Subsystem:	• Paratransit
National ITS Architecture User Service Bundles (optional):	2.1 Public Transportation Management
Related Projects and Initiatives:	• See current IT business plan

11.2.9 Initiative: SI-09-DA Safety and Security

Description: The Safety and Security Initiative is intended to improve safety and security for employees and customers through a set of coordinated technology projects. One component involves safety and security improvements on the revenue vehicles, such as the maintenance and replacement of the Video Surveillance and On-Board CCTV systems. The initiative also includes upgrade or replacement of the incident tracking logs into an incident management system (with potential of tracking incidents in real-time).

The goal of the initiative is to:

- Improve the analysis, reporting, and understanding of safety and security incident data
- Identify and resolve problems more quickly
- Better deploy safety and security resources
- Efficiently and accurately comply with reporting requirements
- Improve safety and security
- Increase ridership, as a secondary benefit, when customers feel more secure

Primary Process(es): Safety and Security (primary); Service Management; Customer Information

Item	Description
Transit Goals Supported:	Goal 1: Maximize Use and Efficiency Goal 4: Innovative Solutions Goal 5: Expand Services Goal 7: Improve Support Services
IT Division Goals Supported:	Goal 1: Enhance Customer Information Goal 2: Improve Business Tools and Information Goal 5: On-Board Vehicle Improvements Goal 6: Enhance Safety and Security

Issues and Considerations:	• Define categories of incidents for all the stakeholder groups. • Scrutiny and strict procedures on access to incident tracking and database will need to be enforced. • Include long-term strategic goal to standardize and combine, where possible, ID cards with a wireless communication component, such as Security access ID cards, contactless smart cards, operator sign-in cards, and cards for paying tolls on the expressways.
MDT Architecture Subsystem	• Surveillance Systems (on-board and at stations) • Incident Management System
National ITS Architecture User Service Bundles (optional):	2.1 Public Transportation Management 5.1 Emergency Notification and Personal Security 5.2 Emergency Security Management
Related Projects and Initiatives:	• See current IT business plan

11.2.10 Initiative: SI-10-DA Traffic Signal Prioritization (TSP)

Description: The Traffic Signal Prioritization (TSP) Initiative involves coordination between MDT and regional traffic control operations efforts. This is a project designated by the Southeastern Florida Regional ITS Architecture.

Phase 1: Coordinate with Service Planning / Implementation and Planning and regional Traffic Operations agencies on corridors, intersections, and priority strategies. Discuss equipment and standards related to implementation. Complete phase with an MOU.
Phase 2: Procure and install on-board equipment for test phase.
Phase 3: Deploy on vehicles assigned to the route / run or corridor.

Primary Process(es): Service Management

Item	Description
Transit Goals Supported:	Goal 1: Maximize Use and Efficiency Goal 3: Regional Systems Goal 4: Innovative Solutions
IT Division Goals Supported:	Goal 2: Improve Business Tools and Information Goal 5: On-Board Vehicle Improvements
Issues and Considerations:	• Review emerging standards in this area for requirements for on-board and signal coordination control (NTCIP 1211). • Understand the difference between preemption and priority and determine which method is more amenable to the signal control organizations. • Target the corridors or intersection with the most need.
MDT Architecture Subsystem	• On-Board Transit Signal Priority
National ITS Architecture User Service Bundles (optional):	1.6 Traffic Control 2.1 Public Transportation Management
Related Projects and Initiatives:	• See current IT business plan

11.2.11 Initiative: SI-11-DA Scheduling Enhancements and Planning Tools

Description: With better on-board data collection techniques, performance data extracted, and service data needed to configure these on-board systems, better tools are needed to manage and analyze the data. Additional tools are available from the existing scheduling software vendor to perform these tasks. Alternative tools may be available from other vendors that will not require significant effort. This initiative is designed to select, procure, prepare the data sets, implement, train end-users, and operate the scheduling enhancement and planning tools.

Primary Process(es): Service Implementation

Item	Description
Transit Goals Supported:	Goal 1: Maximize Use and Efficiency Goal 4: Innovative Solutions Goal 6: Intermodal Linkages Goal 7: Improve Support Services
IT Division Goals Supported:	Goal 1: Enhance Customer Information Goal 2: Improve Business Tools and Information Goal 3: Upgrade IT Environment
Issues and Considerations:	• Additional requirements will emerge when new data sets are acquired through on-board and operations management system replacements and upgrades. Procurement should include a provision that allows MDT to manage the back-end data sets so that new information may be displayed and analyzed.
MDT Architecture Subsystem	• Planning • Scheduling • Core data/GIS
National ITS Architecture User Service Bundles (optional):	2.1 Public Transportation Management
Related Projects and Initiatives:	• See current IT business plan

11.2.12 Initiative: SI-12-DA Workforce Management (TOS Replacement)

Description: The Operator / Maintenance Workforce Management Initiative entails tracking performance of operators and maintenance personnel, including tracking their work assignments, vacations, seniority, and credentials as well as their absences and tardiness, incidents and complaints, and medical (physical) and drug tests needed to comply with legal and contractual requirements.

Primary Process(es): Service Management

Item	Description
Transit Goals Supported:	Goal 1: Maximize Use and Efficiency Goal 4: Innovative Solutions Goal 5: Expand Services Goal 7: Improve Support Services
IT Division Goals Supported:	Goal 2: Improve Business Tools and Information Goal 3: Upgrade IT Environment Goal 5: On-Board Vehicle Improvements Goal 6: Enhance Safety and Security
Issues and Considerations:	• TOS, which this system will replace, was used to configure and load data to the AVL system. TOS is currently responsible for generating and managing incident reports on operators. Many of these functions should be decoupled from the next generation workforce management system or build as middleware or data sets that are not tightly coupled to the workforce management software. • Impacts from operator / maintenance pick / shakeup and operator dispatch processes. • Impacts from the Incident Management System [MDT-AD-009].
MDT Architecture Subsystem	• Workforce Management System
National ITS Architecture User Service Bundles (optional):	2.1 Public Transportation Management
Related Projects and Initiatives:	• See current IT business plan

11.2.13 Initiative: SI-13-DA EAMS — Materials Asset Management/Procurement

Description: The Materials Asset Management and Procurement Initiative includes developing a system that proactively monitors assets to prolong their life for as long as possible. As such, it includes procurement, inventory control and storage, asset tracking, asset history tracking, asset disposal and retirement, and electronic document control (including maintenance manuals). Monitoring suppliers, procurement requests, warranties, and providing access on asset histories to maintenance control are additional functions of Materials Asset Management / Procurement.

Primary Process(es): Asset Management (primary); Internal Infrastructure; Service Management (maintenance)

Item	Description
Transit Goals Supported:	Goal 1: Maximize Use and Efficiency Goal 4: Innovative Solutions Goal 7: Improve Support Services
IT Division Goals Supported:	Goal 2: Improve Business Tools and Information Goal 3: Upgrade IT Environment Goal 6: Enhance Safety and Security
Issues and Considerations:	• Procurement of the application software was just completed and the contract executed. • Resolve coordination issues with county resources planning systems and financial systems.
MDT Architecture Subsystem	• Enterprise Materials / Asset Management System (EAMS)
National ITS Architecture User Service Bundles (optional):	NA
Related Projects and Initiatives:	• See current IT business plan

11.2.14 Initiative: SI-14-DA Finance (GL/AP/AR)

Description: This initiative has the following goals:

- Coordinate with the county to facilitate access to financial data as needed in MDT, particularly for capital projects when the PTP projects are underway.
- Ensure successful interfaces with MDT systems that exchange data with the county financial systems, such as EAMS.
- Eventually incorporate core financial data into MDT's core data repository and data access approach (SI-18-DA Core Data Management).

Primary Process(es): Internal Infrastructure

Item	Description
Transit Goals Supported:	Goal 1: Maximize Use and Efficiency Goal 4: Innovative Solutions Goal 7: Improve Support Services
IT Division Goals Supported:	Goal 2: Improve Business Tools and Information Goal 3: Upgrade IT Environment
Issues and Considerations:	• IT Division needs to be aware as early as possible of upgrades and changes to the county's core financial systems, so impacts to MDT are minimized.
MDT Architecture Subsystem	• Finance • Interfaces to County Systems
National ITS Architecture User Service Bundles (optional):	NA
Related Projects and Initiatives:	• EAMS [SI-13-DA], Decision Support Tool / Datamart [SI-19-DA] ; transit payroll systems • See current IT business plan

11.2.15 Initiative: SI-15-DA Human Resources (Training, Payroll, Employee Information)

Description: Although the county has primary responsibility for many of the Human Resource (HR) systems, this IT Division initiative is intended to facilitate the secure and appropriate access to Human Resources data by authorized MDT staff. Many of the new safety and ITS systems also require employee ID information, so a second component of the initiative is to facilitate system interfaces that convey Human Resources data to MDT systems. As a part of the Core Data Management Initiative (SI-18-DA), core HR should be included.

Primary Process(es): Internal Infrastructure

Item	Description
Transit Goals Supported:	Goal 1: Maximize Use and Efficiency Goal 7: Improve Support Services
IT Division Goals Supported:	Goal 2: Improve Business Tools and Information Goal 7: Improve Skills and Training Program
Issues and Considerations:	• Protect confidential data and carefully manage data access rights
MDT Architecture Subsystem	• Human Resource Systems • Interfaces to County Systems
National ITS Architecture User Service Bundles (optional):	NA
Related Projects and Initiatives:	• ITS and other business applications that use operator ID and other employee information • Core Data Management (SI-18-DA) • See current IT business plan

11.2.16 Initiative: SI-16-DA Electronic Document Storage

Description: This initiative will investigate, specify, procure, and implement a modern document storage and retrieval system.
Phase 1: User Requirements (throughout the organization); identify needs for critical documents; specify indexing needs and scope effort.
Phase 2: Procurement: prepare specification and RFP.
Phase 3: Implement system, including preparation of documents and implementing indexing requirements.

Primary Process(es): Internal Infrastructure

Item	Description
Transit Goals Supported:	Goal 1: Maximize Use and Efficiency Goal 7: Improve Support Services
IT Division Goals Supported:	Goal 2: Improve Business Tools and Information
Issues and Considerations:	• Initial document sets include: o Architectural drawings o Materials safety data sheets • Security access to some documents may be necessary. • Coordination with county efforts where appropriate.
MDT Architecture Subsystem	• Core Data
National ITS Architecture User Service Bundles (optional):	NA
Related Projects and Initiatives:	• See current IT business plan

11.2.17 Initiative: SI-17-DA Capital Project Control

Description: The intent of this initiative is to determine the technical assistance needed by MDT to support capital project control and be positioned to provide appropriate assistance. The first step is to proactively begin discussion with the various parts of MDT that will be actively engaged in capital project management, development, and tracking for the PTP, to determine future potential technology support that will be needed, if any. If technical support is needed, the IT Division will guide an enterprise-wide approach to acquiring and implementing project management support tools. These tools may assist with change order tracking, Groupware communication to large project teams, project management software, and project tracking software.

Primary Process(es): Internal Infrastructure

Item	Description
Transit Goals Supported:	Goal 1: Maximize Use and Efficiency Goal 7: Improve Support Services
IT Division Goals Supported:	Goal 2: Improve Business Tools and Information Goal 3: Upgrade IT Environment Goal 4: Improve Management of IT
Issues and Considerations:	• Assess other resources in the county and region to avoid duplication of effort or tools.
MDT Architecture Subsystem	• Finance / Administration
National ITS Architecture User Service Bundles (optional):	NA
Related Projects and Initiatives:	• See current IT business plan

11.2.18 Initiative: SI-18-DA Core Data Management

Description: Develop a plan to construct core data sets that serve as the system of record (or authority) throughout the organization. This initiative helps coordinate various data management projects and activities, including:

- Bus Stop Inventory
- GIS (development of transit features on county base map; develop linkages to other systems)
- Data configuration for on-board systems
- Performance data management (from on-board systems and other back-office systems)
- Data preparation for planning tools
- Data preparation for CIN [SI-3-DA]

Phase 1: Develop a plan that includes a core data dictionary (format, description, rules, owner, etc.), data relationships (or relational data model), and strategy to populate database by allocating responsibility to specific application procurements; define and implement configuration management approach and procedures, and other core data practices and procedures (see Volume 1, Section 4.3.1).

Phase 2: Manage core database and interfaces. Update data model based on changing requirements. Manage and document data and interface metadata for ongoing projects.

Primary Process(es): All

Item	Description
Transit Goals Supported:	Goal 1: Maximize Use and Efficiency Goal 4: Innovative Solutions Goal 7: Improve Support Services

IT Division Goals Supported:	Goal 1: Enhance Customer Information Goal 2: Improve Business Tools and Information Goal 3: Upgrade IT Environment
Issues and Considerations:	•
MDT Architecture Subsystem	• Core Data
National ITS Architecture User Service Bundles (optional):	2.1 Public Transportation Management 7.1 Archived Data
Related Projects and Initiatives:	• See current IT business plan

11.2.19 Initiative: SI-19-DA Decision Support Tool / Datamart

Description: Develop datamart(s) and decision support tools, allow easy data access, analyses, and reporting. For example, agency performance data should be included in a manner that allows monthly, quarterly, and annual aggregation. In addition, the ability should be provided to easily make comparisons between reporting periods, such as year-to-year. Other appropriate data sets include ridership, National Transit Database, etc.

Primary Process(es): All

Item	Description
Transit Goals Supported:	Goal 1: Maximize Use and Efficiency Goal 4: Innovative Solutions Goal 7: Improve Support Services
IT Division Goals Supported:	Goal 1: Enhance Customer Information Goal 2: Improve Business Tools and Information Goal 3: Upgrade IT Environment Goal 4: Improve Management of IT Goal 6: Enhance Safety and Security Goal 7: Improve Skills and Training Program
Issues and Considerations:	• Must be coordinated with the Core Data Management Initiative
MDT Architecture Subsystem	• Datamart / Archive
National ITS Architecture User Service Bundles (optional):	2.1 Public Transportation Management 7.1 Archived Data
Related Projects and Initiatives:	• See current IT business plan

12 TECHNOLOGY ARCHITECTURE STRATEGIC INITIATIVES

Seven strategic initiative areas were identified to improve the Technology Architecture and physical infrastructure support at MDT. These initiatives include an On-Board Communications / Integration with Back-End Systems Initiative (SI-27-T) that is closely related to the On-Board Bus Infrastructure and Replacement Initiative (SI-01-DA).

12.1 Fixed-End Technology Initiatives

12.1.1 Initiative: SI-21-T Data Center Systems Environment Modernization

Description: This project will identify existing system platforms within the Data Center for replacement, co-existence, and / or to provide a modern systems environment that can support current capacity and be leveraged for future business needs. The objective is to modernize the systems environment supporting key business systems. As migration will take place over a number of years (2003–2008), a well-developed and deliberate transition plan based on the IT Guiding Principles will be developed to ensure reliability and address security, performance, and scalability requirements. Candidates for replacement platforms are characterized by outdated technology and escalating maintenance issues such as lack of vendor support or inaccurate documentation. Co-existence between new and legacy operations platforms supporting transportation operations (Rail, Bus, Mover) will be required in this same time period. Candidates for replacement will be placed in an operationally frozen state where only fault and regulatory problems are repaired or maintained using change management procedures. Three environments must be addressed: (1) execution or how well applications will run in production; (2) development which addresses migration from legacy software to new; and (3) operations to support applications and data in a controlled, secure manner. The build out of the target architecture in this transition period must be given the same prioritization and attention as any comparable application development effort using standard IT SDLC procedures and project controls.

Primary Process(es):

Item	Description
Transit Goals Supported:	Goal 1: Maximize Use and Efficiency Goal 4: Innovative Solutions Goal 7: Improve Support Services
IT Division Goals Supported:	

Issues and Considerations:	• Migration plan may require dual platform operations to facilitate transition testing, migration and historical reporting. • User experience expectations may need to be managed due to client/server performance characteristics, particularly when deployed over a WAN. • Network capacity planning will be increasingly important to ensure consistent application responsiveness.
MDT Architecture Subsystem	• Internal Infrastructure o Platforms and Servers o Business Systems
Related Projects and Initiatives:	• See current IT business plan

12.1.2 Initiative: SI-22-T Desktop Support Automation and Configuration Standardization

Description: Establish and deploy a standardized desktop configuration image which will bring all desktop platforms to current software releases of office automation tools, e.g., Windows, Office. The standardized desktop will be enabled with system management tools to improve enterprise security, support application roll-outs, and reduce support and systems management costs. This capability will allow desktop support staff to manage the desktop environment more remotely, improving and automating software deployment, security patch management, and establishing an inventory of desktop configuration versions for improved support and license compliance purposes.

Primary Process(es):

Item	Description
Transit Goals Supported:	Goal 1: Maximize Use and Efficiency Goal 4: Innovative Solutions Goal 7: Improve Support Services
IT Division Goals Supported:	
Issues and Considerations:	• Closely evaluate the current ITD standard of Tivoli TMS. • Consider Ghost console for image management. • Integration with Helpdesk management tool will assist with inventory management, change management, and end of life replacement.
MDT Architecture Subsystem	• Internal Infrastructure o Office automation environment o Desktop equipment
Related Projects and Initiatives:	• See current IT business plan

12.1.3 Initiative: SI-23-T Model IT Operational Procedures

Description: Capture and document existing operational process models and inter-departmental support arrangements. These models will help identify key monitoring points of a system management framework. In addition, key operational support objectives and technical service levels will be defined using baselines of current capabilities and technical service delivery.

Primary Process(es):

Item	Description
Transit Goals Supported:	Goal 1: Maximize Use and Efficiency Goal 7: Improve Support Services
IT Division Goals Supported:	
Issues and Considerations:	• Using existing Helpdesk and escalation models will facilitate capturing, documenting and defining operating level agreement, technical operation procedures, and service level agreements
MDT Architecture Subsystem	• Internal Infrastructure o Operating Level Agreements o Technical Operating Procedures o Service Level Agreements
Related Projects and Initiatives:	• See current IT business plan

12.1.4 Initiative: SI-24-T Distributed Network Design

Description: Redesign the enterprise wide-area network to be a fully routed network and include quality of service enhancement. This initiative will improve the efficiency of network services and identify cost reducing opportunities by accessing capacity, performance, and availability requirements. Key activities will include defining quality of service requirements (self-healing, high availability, and fast recovery), access vendors and service providers, QoS capabilities, develop detail design and migration plan, and establish an implementation project plan and team, as well as close coordination with M-D County IT over the use of county-provided network infrastructure and services.

Primary Process(es):

Item	Description
Transit Goals Supported:	Goal 1: Maximize Use and Efficiency Goal 4: Innovative Solutions Goal 5: Expand Service Goal 6: Intermodal Linkages Goal 7: Improve Support Services
IT Division Goals Supported:	
Issues and Considerations:	• Network service provider functional capabilities will need close evaluation to ensure fit with design requirements. • Network equipment and configuration standardization should be defined as a key deliverable to reduce support complexity and costs.
MDT Architecture Subsystem	• Internal Infrastructure o Wide Area Network o Local Area Network
Related Projects and Initiatives:	• Fiber optic installation • MDT Backbone Upgrade • See current IT business plan

12.1.5 Initiative: SI-25-T Network and System Management

Description: Design an end-to-end systems monitoring framework, which will proactively provide the capability to measure and monitor service availability and performance, and both capture and measure end-user experience. In addition, the management framework model will assist in assessing the capability of existing tools and determine gaps where additional system management and diagnostic tools are required. Operational support objectives and procedures will also help define key requirements used to evaluate vendor functional capabilities and fit. The implementation phase will ensure key deliverables provide proactive problem determination, an enterprise event console, end-user experience monitoring, and service-level reporting.

Primary Process(es):

Item	Description
Transit Goals Supported:	Goal 1: Maximize Use and Efficiency Goal 4: Innovative Solutions Goal 7: Improve Support Services
IT Division Goals Supported:	
Issues and Considerations:	• The Tivoli TMS platform, a M-D County IT standard, may be leveraged to provide a consolidated infrastructure management platform. • System management vendor end to end monitoring vision may be more hype than actual delivered functionality; careful evaluation is required. • Investment requirements can be extremely high; a phased approach of capability deployment may ease budget concerns and allow tuning of the framework as vendor capabilities mature and procurement costs lower. • Recommended vendor short list: NetIQ AppManager, Microsoft MOM, Tivoli TMS, HP OpenView
MDT Architecture Subsystem	• Internal Infrastructure o Enterprise Systems Management o Enterprise Network Management
Related Projects and Initiatives:	• See current IT business plan

12.1.6 Initiative: SI-26-T Quality Assurance/Application Development Environment

Description: This initiative provides an isolated hardware/software and networking environment to support all tasks involved in providing quality assurance to critical business systems prior to release into production, and improved efficiencies in development (analysis, design, construction, and maintenance). The system environments will be clearly delineated development and quality assurance (QA) testing environments isolated from production, with individualized security and operational characteristics. The QA and development environments will require the same attention as a similarly sized end-user execution environment. Quality management, system building, environment management, and program and project management tools will be applied to improve quality of systems and productivity improvements for technical staff.

Phase I will enhance the current Applications Development Environment to reduce uncoordinated change to same modules, eliminate reentry of source code due to accidental deletion, eliminate repeated design, coding, testing, maintenance of very similar logic., and remigration to system test because impact analysis for a change request was incomplete.

Phase II will enhance the Quality Assurance environment to provide separate and automated regression testing for functionality, high-volume systems and load testing to ensure performance, and verify that new releases, application enhancements, key interfaces, and vendor fixes are implemented reliably prior to release into production. New technologies such as high availability clustering and middleware components for mission critical systems will also undergo vigorous quality assurance testing prior to production release.

Primary Process(es):

Item	Description
Transit Goals Supported:	Goal 1: Maximize Use and Efficiency Goal 4: Innovative Solutions Goal 7: Improve Support Services
IT Division Goals Supported:	
Issues and Considerations:	• Cost/complexity will be dependent on the number of platforms, target environment complexity, and size of system being developed/maintained.

MDT Architecture Subsystem	• Internal Infrastructure o Platforms and Servers o Business Systems
Other Related Projects and Initiatives:	• See current IT business plan

12.2 On-Board Technology Architecture Initiatives

The On-Board Technology Initiative deals with the various communication technologies that support communication with the transit vehicle. Although the initiative deals primarily with communications, it is closely coupled with SI-01-DA, On-Board Bus Infrastructure and Replacement. Marrying these two strategic initiatives is critical to the successful implementation of ITS applications with on-board components such as AVL, APC, and annunciators. Consequently, this initiative is called On-Board Communications / Integration with Back-End Systems (SI-27-T); MDT must vigilantly coordinate the implementation of on-board ITS applications with communications systems that enable these applications and data sets.

One of the goals of this initiative is to minimize the number of different variations on a technology that are implemented and then need to be maintained. For example, choices about on-board wireless technologies should be considered within a larger technology context that includes wayside and back-office wireless needs. An enterprise-wide perspective, rather than a project-centric perspective, is critical to success.

12.2.1 Initiative: SI-27-T On-Board Communications/Integration with Back-End Systems

Description: This initiative provides design, coordination, and integration support to ensure that on-board vehicle digital radio communications, Vehicle-Area-Networks (VAN), and wireless networks support the ITS and information needs of MDT. The intent is to enable the successful implementation and integration of on-board ITS applications such as AVL, APC, annunciators, and electronic fare collection. The VAN, radio communications, and wireless networks should support the collection of large volumes of on-board information in real-time and batch mode. Critical related initiatives to the on-board communications initiative include any on-board ITS applications and the On-Board Bus Infrastructure and Replacement Initiative (SI-01-DA).

The On-Board Communication / Integration with Back-End Systems Initiative will also support transparency of passing data defined by published standards (i.e., SAE-J1587, TCIP) and management of wireless standards both on-vehicle and off the vehicle. The coordination efforts will begin at procurement to include requirements for systems integration at the data level. The data and metadata interface requirements will leverage ITS TCIP Data Standards for data content and message sets, as well as forms of security software. Wireless communications and digitally enhanced radio communications will be tested to enable the secure and manageable real-time transfer of the massive amounts of data required by subsystems on the vehicle, as well as large amounts of performance data collected on the vehicle which is normally transferred as batch data at the end of the day.

Item	Description
Transit Goals Supported:	Goal 1: Maximize Use and Efficiency Goal 2: Educate the Community Goal 4: Innovative Solutions
IT Division Goals Supported:	Goal 1: Enhance Customer Information Goal 2: Improve Business Tools and Information Goal 3: Upgrade and Standardize Goal 5: On-Board Vehicle Improvements
Issues and Considerations:	• Migration plan may require dual platform operations to facilitate transition testing, migration, and historical reporting. • User experience expectations may need to be managed due to client / server performance characteristics particularly when deployed over a WAN. • Network capacity planning will be increasingly important to ensure consistent application responsiveness.

MDT Architecture Subsystem	• Internal Infrastructure
	  o Platforms and Servers
	  o Business Systems

Related Projects and Initiatives:	• On-Board Bus Infrastructure and Replacement [SI01-DA], Bus Traffic Control Management [SI-05-DA], APC [SI-02-DA], GPS, Electronic Fare Collection [SI-07-DA], maintenance diagnostics (AVM), etc. • See current IT business plan

13 IT ORGANIZATIONAL STRATEGIC INITIATIVES

Eight strategic initiative areas were identified to improve the organization and operation of the Information Technology Division. The eight initiative areas are listed below.

- Administrative Planning (SI-31-O)
- Policy Development and Standards (SI-32-O)
- Service Management (SI-33-O)
- Project Management (SI-34-O)
- Business Process Reengineering (SI-35-O)
- Skills Planning and Training Program (SI-36-O)
- Target Organization / Transition Management (SI-37-O)
- IT / ITS Strategic Planning (SI-38-O)

13.1 Administrative Planning (SI-31-O)

The strategic initiative to improve administrative planning in the IT Division has several sub-areas targeted for emphasis over the next five years. One of the most important areas is obtaining consensus and support from MDT management on the capital project priorities of the IT Division. Enhancements to the budget planning process will improve the availability of needed funding, by obtaining grants, and by improving resource forecasting.

13.1.1 IT Capital Project Approval Process

Figure 13-1 presents a recommended IT capital project approval process that involves MDT managers at key points in an IT project's life cycle. This approval process is designed to involve key decision-makers at critical points, for informed decision making and obtaining the benefits of management leadership and support. Some of the benefits of the approval process include:

- Improved agency-wide knowledge of Transit's technology investments
- Priority setting from an agency-wide perspective
- Improved opportunity for identifying additional stakeholders and project impacts
- Agency-wide consensus and support of the IT capital project priorities
- Reduction in project and budget risks by using a phased approach that refines the project scope, schedule, and budget at each phase before proceeding to the next phase.

The project approval process in Figure 13-1 shows five project phases where formal approval is appropriate. After the project has been approved in the Transit budget, the two additional approval points are very important for larger, more complex projects, such as an AVL or fare collection system. If the project is not large or complex, fewer additional approval steps may be needed. The number of approval steps can be decided in the budget phase.

In developing IT / ITS projects for Transit management approval, possible criteria for prioritizing projects include the following: the project is required legally, meets business goals, ensures one or more critical success factors, has an excellent cost / benefit analysis, provides required infrastructure support, and meets a critical safety need.

13.1.2 Operations and Maintenance Budget Forecasts

One of the biggest challenges for a transit IT group during a period of rapid transit service expansion is having the resources available for unanticipated and "last minute" projects that must be funded by the operations and maintenance (O&M) budget. Several administrative planning business practices can help mitigate the problem, such as:

- A simple system for forecasting and tracking actual operations and maintenance project efforts is valuable.
- Having a schedule of regular required O&M tasks can reduce the number of unanticipated projects.
- The problem of unanticipated work can be further mitigated by annually asking business clients about probable changes in their O&M needs for the coming year.
- Despite the best forecasting, unexpected changes in the business environment and needs occur between budget cycles. Keeping a log of all unanticipated work can provide baseline data for forecasting unanticipated workloads in future years.

13.1.3 Increase Grant Funding

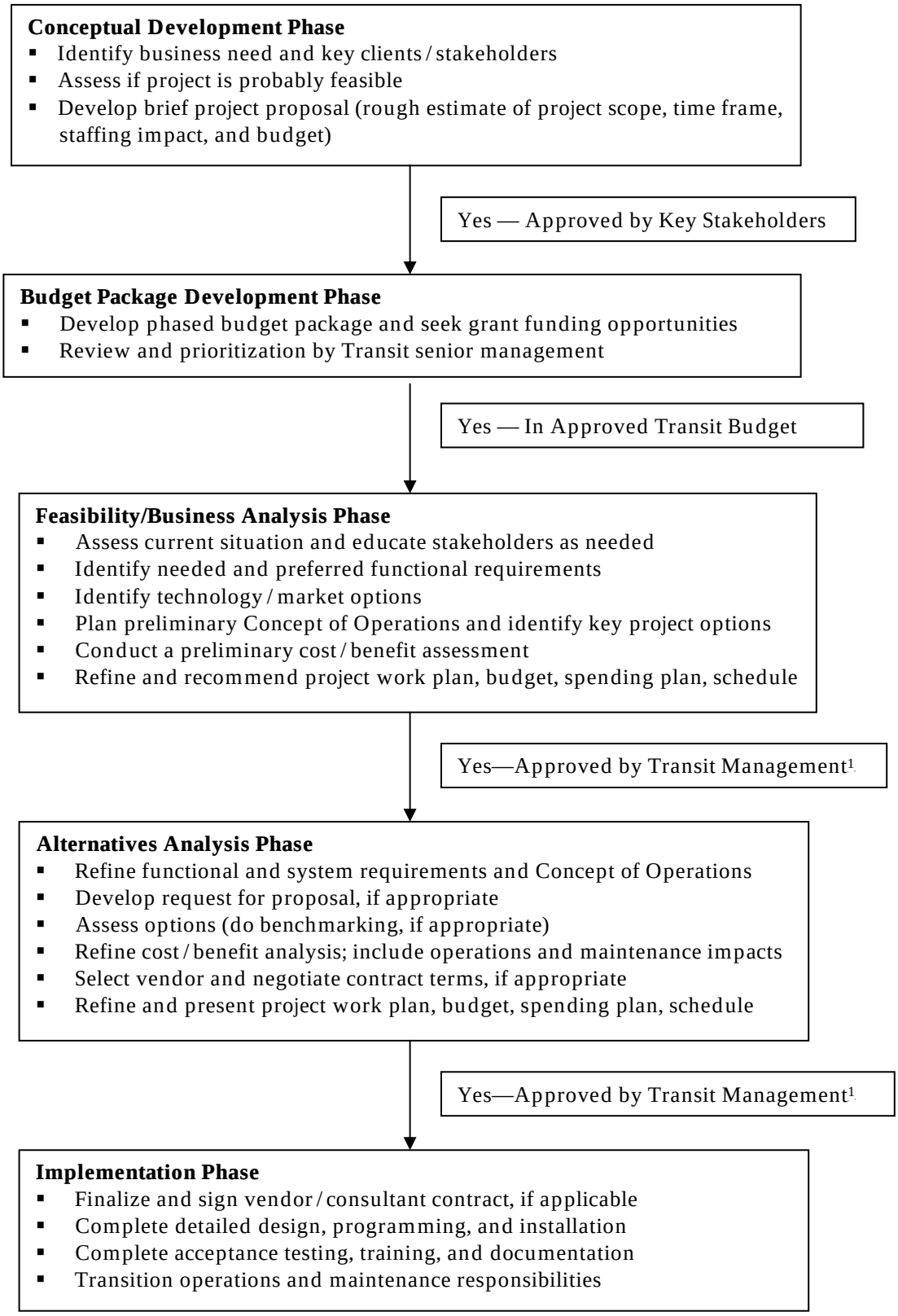
Increased communications with the Grants function, the Metropolitan Planning Organization, and other regional organizations to identify grant opportunities will increase the probability of supplementing IT project budgets with grant funds. The recent Federal Transit Administration Policy on National ITS Architecture Policy regarding Transit Projects encourages regional partnerships to leverage ITS project funding. Over the next five years, the IT Division should identify and pursue grant funding opportunities for internal as well as regional projects.

13.1.4 Job Classifications

Sometimes, as technology changes, new technology-related job categories are required. To manage reclassification issues and budget implications, IT management should work with Human Resources to get new job classifications in place before a large number of employees exist in the workplace that are doing the new body of work.

Some transit agencies have suffered negative budget impacts and staff morale issues, because they did not create new classifications in a timely manner. For example, many new ITS systems require someone, preferably in the business unit rather than IT, to review diagnostic reports, generate user report, and update key parameters and data needed to operate the system. This body of work usually requires new skill levels, but generally doesn't fall into existing IT job classifications.

Figure 13-1 Capital IT Project Approval Process



[1] The senior management team or, at a minimum, the directors for all the affected business areas.

13.2 Policy Development and Standards (SI-32-O)

IT industry standards constantly evolve and new IT related policies are developed at the regional, county, and IT Division level. MDT's IT Division should maintain an ongoing process to stay informed about industry changes, assess options, adopt appropriate standards and policies, and train and communicate them to affected staff.

In order for MDT to successfully implement and deploy the integrated systems and processes defined in this document, compliance with the EAP plan should become institutionalized with a policy and process. A process should be defined to determine a project's compliance to adopted standards (data and technology) and integration requirements. A subset of the process should address how to resolve proposed incidents of noncompliance. In some cases, a policy and process waiver should be allowed. As an example, a "proof-of-concept" project that does not follow the agency standards may bring significant insight and enhancement to the EAP. To enforce this policy, it is necessary to train business and IT staff in the Policy compliance criteria of the Enterprise Architecture Plan, and conduct integration reviews at key project milestones.

13.3 Service Management (SI-33-O)

The IT Division needs service management processes and tools that are updated and monitored regularly to provide cost effective, timely, and quality IT services. The following service management practices are key to excellent IT services:

- Use of performance measures
- Use of service level agreements
- Implementation of a quality assurance program

13.3.1 Performance Measures

Performance measures should be developed and implemented for the various services provided by the IT Division. Customers and stakeholders of the IT Division should be interviewed to better understand their service requirements and expectations. For performance measures to be useful and successful, after they are developed a number of additional steps must be completed. The performance data must be gathered regularly, the indicators must be monitored, and corrective actions must be taken as needed. The performance indicators should drive desired behaviors and performance. Characteristics of good performance measures are the following: valid, manageable, timely, visible, inexpensive, interpretable, benchmarked, and motivating.

The work completed by the Gartner Group at the request of the IT Division on performance indicators and benchmarking is an important step.

13.3.2 Service Level Agreements

The definition, negotiation, adoption, and monitoring of Service Level Agreements (SLA) are critical steps in assuring reliable and high quality IT service provision. Since MDT's IT Division operates within a regional and county context, SLA's are appropriate between the

county and MDT for county-provided services, between MDT and vendors, and between MDT and regional partners, such as for the Consumer Information Network project. In some cases, SLA's are appropriate between the IT Division and MDT business units for major internal IT projects.

13.3.3 Quality Assurance Program

A quality assurance program is essential in a modern, effective IT organization. The allocation of staff resources and funding for developing and operating a quality assurance program is a wise long-term investment. The cost of such a program is justified by its ability to help projects avoid project cost overruns, project delays, and negative publicity over preventable problems. Strategic Initiative SI-27-T, Quality Assurance/Application Development Environment, addresses the technical aspects of a quality assurance program.

13.4 Project Management (SI-34O)

An organizational strategic initiative to continue improving project management is critical to the success of MDT's IT and ITS project investments. Further supporting the need for quality project management practices is the relatively new FTA National ITS Policy on Transit Projects that specifies project management-related requirements. The following web site contains additional detail on those requirements: www.its.dot.gov/aconform/aconform.htm.

13.4.1 Systems Development Methodology

Many different systems development methodologies exist in the IT marketplace, but many of them are cumbersome to use. As a part of this initiative, the IT Division will assess and adopt a methodology for use. A number of resources on the topic exist, including at the Florida State Technology Office (www.myflorida.com/myflorida/sto/isdm). The systems development methodology that is adopted should consider all aspects of the project, including people, processes, and technology.

13.4.2 IT/ITS Project Development Stage Considerations

This section, IT/ITS Project Development Stage Considerations, highlights seven possible stages in a project's development and some of the key activities within each stage. To obtain maximal buy-in and support of the business area clients, they should be partners in all the stages. The use of "walk-throughs" in many of the stages and prototyping, where appropriate, help ensure educated and supportive clients. Depending on the size and complexity of the project, the various stages of the project may be grouped into a number of project budget phases. For larger and more complex projects, Transit management approval to proceed should be obtained after key budget phases, such as the Feasibility and Alternatives Analysis Phases. For small and noncomplex projects, one budget phase may be all that is needed.

Conceptual Development Stage

- Identify business need and key clients/stakeholders
- Determine possible regional partners and regional ITS architecture considerations
- Assess if project is likely to be feasible

- Develop brief project proposal (rough estimate of project scope, time frame, staffing impact, and budget)
- Present project concept and proposal to key stakeholders, to obtain their feedback and approval

Budget Package Development Stage

- Develop a budget package that proposes that the project will be developed in phases, most commonly a Feasibility/Business Analysis Phase, an Alternatives Analysis Phase and an Implementation Phase. The number of phases proposed would be determined by the size of the project, the probable risks, and the ability to accurately project a scope, schedule, and budget that can be met. Use each phase as an opportunity to refine the scope, schedule, and budget.
- Seek grant funding opportunities
- Review and prioritization of capital IT project budget proposals by Transit senior management

Project Initiation and Preliminary Planning Stage

- Begin preliminary project planning
- Define the project team and its responsibilities
- Identify the Management Oversight Steering Committee
- Develop a preliminary project plan, considering systems engineering principles and FTA policy requirements
- Develop project charters that the various stakeholder groups sign, accepting their roles and responsibilities on the project
- Refine scope, schedule, and budget

Feasibility/Business Analysis Stage

- Assess the current situation and educate stakeholders, as needed, about issues, technology options, and business needs of other parts of the organization that are relevant to them and the project
- Identify needed and preferred functional requirements
- Identify technology and market options
- Plan preliminary Concept of Operations that concisely states what the system should do from a user's perspective
- Identify key project options
- Assess risks
- Document high-level functional requirements
- Complete a preliminary cost/benefit assessment report, including life cycle costs
- Determine if the project makes business sense. Is it feasible and likely to be cost effective?
- Develop a recommended work plan, budget, spending plan, and schedule
- Produce a Business Analysis/Feasibility Report and present the findings and recommendations to Transit senior management for approval
- Refine project work plan, budget, spending plan, schedule based on management input

Alternatives Analysis Stage

- Refine functional and system requirements and Concept of Operations
- Develop Request for Proposal, if appropriate, that also identifies architecture and standards requirements and protects intellectual property issues
- Assess options (do benchmarking, if appropriate)
- Refine cost / benefit analysis; include operations and maintenance impacts
- Select vendor and negotiate contract terms, if appropriate
- Refine project work plan, budget, spending plan, and schedule
- Recommend the preferred alternative to Transit senior management and obtain approval to proceed to the next phase
- Incorporate management changes and recommendations

Implementation Stage

- Finalize and sign vendor / consultant contract, if applicable
- Revise stakeholder charters and other internal or regional project agreements
- Finalize detailed project plan
- Complete detailed design, programming, and installation
- Request and review systems and user documentation throughout the implementation of the project as components are completed, rather than at the end of the project
- Follow up to ensure that operations and maintenance resources will be available when needed
- Complete acceptance testing, training of users, and system support staff
- Determine if a warranty / transition period is needed
- Transition operations and maintenance responsibilities

Project Closeout Stage

- Resolve any outstanding items
- Obtain final sign-off and approval of the project by the clients
- Conduct a facilitated session with the project team and key stakeholders to determine what went well during the capital project and what lessons were learned

13.4.3 Project Management Tools

The provision of project management tools and project tracking tools, along with training in their use, will help ensure the successful implementation of MDT's technology investments. It is more efficient if IT Division has an expert on the project management tools available to help project managers who use the advanced features of the tools infrequently.

13.5 Business Process Reengineering (SI-35-O)

The effectiveness of the IT Division project managers will be increased with the provision of introductory business process reengineering training. As with the project management tools, one expert staff person in the IT Division could provide coaching and technical expertise to the other project team members, as needed.

13.6 Skills Planning and Training Program (SI-36-O)

A skills planning and training program needs to be funded and implemented to support the design, development, implementation, maintenance, and operation of the technology projects proposed in this IT / ITS Strategic Plan to meet the needs of MDT and the PTP. This training initiative has the following components:

- Train IT Division to have the skills necessary to:
  - Be technically proficient (e.g., Oracle, GIS skills)
  - Be effective project managers
  - Be effective communicators with clients and in producing project documents
  - Serve as backup staff on assigned projects, as needed
  - Grow as an employee through other professional development skills
- Help create and support a technology-literate user community within MDT
- Assist MDT as needed with agency-wide training development and tracking programs

13.7 Target Organization / Transition Management (SI-37-O)

This initiative addresses the need for the IT Division to migrate toward a Target Organization to meet the increasing demands on staff for:

- New systems, data, and data access
- Upgrades and enhancements to existing systems
- The development of a more robust and flexible technology infrastructure
- The maintenance and operation of increasingly complex IT / ITS systems

Section 13.7.1 identifies some of the additional issues that the IT Division will have to handle as the Data and Applications Architecture and the Technology Architecture change. Section 13.7.2 presents two looks at IT industry best practices for the definition of needed IT functions or processes in a modern, Target IT organization.

13.7.1 Organizational Transition Period

To meet MDT's strategic goals, the IT Division will have to leverage enterprise resources and build upon a common technology infrastructure with skilled personnel, reengineered processes, integrated applications, and enterprise-wide data resources. Moving forward, the IT Division will need to refocus the organization to implement a modern systems environment based on IT Guiding Principles. Through the transition period, the IT Division will need to provide services with sufficient reliability to meet the needs of today while building to support the future.

The transition process needed to deliver N-Tier distributed architecture systems solutions will likely last several years. There are many costs and challenges that are associated with moving from the current environment to a distributed systems architecture. Cost is defined in terms of hard costs as well as technology risk (control, complexity, performance, and management). As the Target Architecture evolves, IT designers and architects must continuously work to balance business needs, systems management, costs, performance, and reliability.

Over this period, MDT will move through evolutionary stages of distributed architecture approaches. It may be expected that multiple client/server computing models will require support, and legacy systems will continue in place for some time.

The IT Division organization will evolve as the group moves to support existing and new IT functions and processes in a continually changing IT environment. Change is expected to occur in phases over the next five-year planning horizon. MDT's IT management expects that a strong change management program will be required as customer perspectives and requirements change and as the technology environment changes. The IT Division began the process of redeveloping the face of technology at MDT over the last few years, guided by the 2000–2002 Strategic Plan. The IT Division is now positioning itself to make the next level of significant changes to provide new and improved IT products and services.

13.7.2 Target IT Organization: Functions and Processes

As technology options multiply and grow more complex, the IT industry has the constant challenge of updating and supplementing the processes, functions, and skills necessary to operate a successful IT organization. Figure 13-2 and Figure 13-3 present two alternative views from the IT industry of the target IT functions and processes that are considered necessary for an IT organization to achieve success.

These charts *do not* represent an organizational chart or organizational structures. Instead, the charts identify and link the multiple IT processes or functions that are recommended for a Target IT organization. Both models are based on the need to manage IT resources at three levels: strategic, tactical, and operational.

Based on the two approaches for describing best practices that are shown in the figures, the IT Division needs to strengthen its current capabilities in the areas of Quality Assurance, Service Level Planning and Monitoring, Business Reengineering, and Systems Integration and Engineering. With the forecasted growth in Transit service and project implementations due over the next five years according to the PTP, the current staffing and skill levels within the IT Division need to be expanded and improved. The growth in IT staff and skills is needed to properly support the forecasted growth in IT/ITS applications, their infrastructure, and the data demands that will be placed on them.

Within a Target Organization for MDT's IT Division, certain key positions/skill sets are particularly crucial, including the following:

- Technically skilled Database Administrators (DBA)
- At least two levels of GIS expertise
- A Quality Assurance expert
- Systems Architecture skills
- An expert in business process reengineering to coach and support IT and MDT staff on new projects
- High-level expertise in systems engineering, project management, and project management tools
- Supplemental planning and forecasting resources and skills to assist the management team

Obviously, many other skill sets and positions are required and exist within the current IT Division. However, the list above reflects the areas that should receive priority in seeking to improve the Division's resources and skills.

Given today's complex IT environments, most modern IT organizations require that the management lead and assist cross-functional, matrixed teams. The target IT organization for MDT will need to provide clear accountability and responsibility for multiple IT processes or functions, some of which do not exist today. Strong leadership that communicates a clear and consistent direction through a common vision, goals, and guiding principles is key to success. In addition, cross-functional management skills must be coupled with skilled, matrixed teams to implement technology solutions services that are reliable, cost-effective, and on time.

Another factor that will affect the success of the IT organization in implementing technology solutions is the extent of communication and coordination within MDT and the county on some IT/ITS projects such as fare collection, AVL, and APCs. The distribution of responsibility within MDT for various aspects of technology provides both strengths (from the diverse skills sets and partnerships) and potential risks if an enterprise-wide perspective is not maintained. For projects with a wide range of stakeholders, IT needs to clearly define the service model, including roles and responsibilities, necessary to ensure quality solutions are provided on a timely basis. Management support is critical to ensure the appropriate service model and service levels are in place.

Figure 13-2 Model A: PLAN/BUILD/RUN

Full in-house support with 36 IT processes managed by 5 subfunctions grouped under 3 functions

Plan			Build	Run
Business Unit Services	**Administrative Services**	**Systems Architects**	**Development**	**Operations**
Business Strategic Planning	Policy Management and Administration	Architecture Definition and Development:	Project Management	H/S Install, Upgrade and Maintenance
IT Strategic Planning	Service Monitoring	Application Planning	Application Development	Capacity/Tuning/ Systems Balance
Service Level Planning	Tactical Plan Management	Data Planning	Application Procurement	Capacity/Tuning/ Systems Balance
Service Level Marketing	Resource Management/Training	Technical Planning	Application Maintenance	IT Security and Disaster Recovery
Business Re-engineering	Financial Administration: Budget, IT Investment/Acquisition	Standardization	Systems Integration and Engineering	Production Scheduling and Distribution
Customer Relations	Staff Performance	Security Planning	Application Customer Support	Resource/Data Inventory and Performance Control
	Audit Planning	Quality Assurance		Infrastructure Customer Support/Problem
	Regulatory Reporting	Project Evaluation		Core Data Management

Figure 13-3 Model B: Applications/Infrastructure/Technology Management

Full in-house support with 20 IT processes managed by four subfunctions grouped under 3 functions

Applications		Infrastructure	Technology Management	
Business Systems	Customer Relations / Requirements	Systems Architecture and Standardization:	IT Policy Management and Administration	IT Investment and Acquisition
Transit Systems	Business Process Re-engineering	Systems Integration and Engineering	Project Management	Quality Assurance
	Tactical Plan Management	IT Security / Disaster Recovery	Resource Management	Contract Administration
	Application Customer Support	Core Data Management	Training	Security and Disaster Recovery
		IT Infrastructure H / S Install, Upgrade, Tuning	Performance Management	
		Production Scheduling / Distribution	Regulatory Reporting	
		Infrastructure Customer Support / Problem Resolution		

13.8 IT/ITS Strategic Planning (SI-38-O)

This IT / ITS Strategic Plan documents the findings of a process. In some ways, the process has more value than the plan, or certainly equivalent value, and it touches more MDT staff than might actually read this plan. The process solicits information, background, and IT needs of MDT, customers, and stakeholders which educates both IT staff and stakeholders; it fosters discussion of issues and trade-offs; and it results in decisions, directions, and updated documentation.

The IT / ITS Strategic Plan should be considered a living document that is revisited on an annual basis with portions of it updated annually. Each year, some form of an environmental scan should be completed that includes contacting customers / stakeholders to identify new or changed business and IT needs. Goals, objectives, training needs, the operating budget, and the proposed set of capital projects need to be refined and detailed annually. Finally, the strategic roadmap and detailed plans must be communicated to MDT management and IT staff.

14 REFERENCES

META Group:
Host Data-Sharing Framework: Part 1—Overview. File 768, 2 August 1999.
The Challenge of Adaptive EAI Infrastructures. File 762, 28 July 1999.

Gartner Group:
Middleware: The Glue for Modern Applications, R-08-2601, 26 July 1999.
Middleware Deployment Trends: Survey of Real-World Enterprise Applications, R-07-4976, 2 April 1999.
Application Server Management: Requirements, COM-17-1664, 6 August 2002.

Other MDT IT/ITS Strategic Planning Documents:
2003 Transit Strategic Planning Retreat for the Management Staffs of Miami-Dade Transit Agency and the Office of Public Transportation Management. The Palisades Group USA, May 29, 2003.

Information Technology and Intelligent Transportation Systems 2003–2008 Enterprise Strategic Plan: Interim Report. The Palisades Group USA, July 26, 2003.

Information Technology and Intelligent Transportation Systems 2003–2008 Strategic Plan: Physical Target Architecture Workshop Report. The Palisades Group USA, September 2, 2003.

Information Technology and Intelligent Transportation Systems 2003–2008 Strategic Planning Process Technical Memorandum: Areas for Architecture Enhancement. The Palisades Group USA, September 10, 2003.

Information Technology and Intelligent Transportation Systems 2003–2008 Strategic Plan: Target Logical Architecture Workshop. The Palisades Group USA, October 10, 2003.

Volume I: *IT/ITS 2003–2008 Strategic Plan Summary*. The Palisades Group USA, December 2003.

Intelligent Transportation Systems (ITS) 2003–2008 Strategic Plan. The Palisades Group USA, December 2003.

Other Sources:
Enterprise Wide Information Technology Architecture (EWITA) links and resources: http://www.ewita.com/.

The Open Systems Interconnection (OSI) Reference Model, developed by the International Standards Organization (ISO).

Britton, Chris. *IT Architectures and Middleware: Strategies for Building Large, Integrated Systems*. Addison-Wesley, 2001.

Goodyear, Mark, editor. *Enterprise System Architecture: Building Client-Server and Web-Based Systems.* Auerbach Publications, 2000.

Spewak, Steve H. *Enterprise Architecture Planning: Developing a Blueprint for Data, Applications and Technology*. John Wiley & Sons, 1992.

15 APPENDIX A: DETAILED DATA AND APPLICATION ARCHITECTURE

(Under separate cover)

16 APPENDIX B: DETAILED TECHNICAL ARCHITECTURE

(Under separate cover)

17 APPENDIX C: FLORIDA STATEWIDE REGIONAL ARCHITECTURE

Published by Florida Department of Transportation, available for download at:
http://www.jeng.com/html/florida/districts/D7/sausage%20Tampa.pdf

18 APPENDIX D: FLORIDA SE REGIONAL ITS ARCHITECTURE DATA FLOWS

Published by Florida Department of Transportation, available for download at:
http://www.jeng.com/html/florida/districts/D4D6/sausage%20SE%20Florida.pdf